

MASTERVOLT
SOLAR
POWER
SYSTEMS

2008

Power conversion solutions for
grid connected and autonomous solar systems

Light and heat. The power to stay healthy. The capacity to grow. The sun is the sustainable source of energy for life on this planet. And thanks to modern technology, we can optimise the output taken from this energy. The sun is a shining example of efficient power generation without harming the environment. Turning solar energy with the best possible output into electrical power that comes out of a socket is the ultimate challenge. And this is where Mastervolt comes in.



Mastering the power of the sun

Mastervolt develops and manufactures top-quality power electronics that converts the power of the sun into usable electrical energy. Equally at home with grid connected and autonomous applications, Mastervolt is a vital link in PV systems throughout the world.

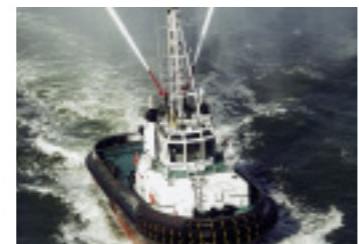


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Mastervolt: **A partner with power**

A reliable energy supply in all places and at all times. With this mission, Mastervolt has developed into a leading player in a wide range of markets over the past decade. On a global scale, Mastervolt now plays a key role in the fields of mobile and maritime power provision, both recreational and professional. And the same applies to solar energy. Mastervolt offers the craftsmanship, expertise and products you need to turn the power of the sun into high-quality energy.



Mastervolt: **Master grid connected inverter systems**

Mastervolt string inverters are integrated in high-tech dual-axis solar tracking systems. These systems increase the production of photovoltaic solar energy by more than 35% compared to fixed installations. The photograph shows recently installed systems in Navarra, Spain, utilizing Sunmaster solar inverters.



Custom-made power: **The Sunmaster series**

Developed for grid connected applications and offering an exceptionally high efficiency, Mastervolt Sunmaster inverters get the most out of solar panels. Switch mode technology makes bulky and heavy transformer technology superfluous. As a result, Sunmaster inverters are exceptionally compact and lightweight. Monitoring via a PC is standard, and an extensive data logging system is available as an option.

The power of global experience

Partnering with Mastervolt brings you all the benefits of international experience and know how. Whether standalone or connected to the grid, our high-tech equipment is installed throughout the world by those who value a reliable and sustainable energy supply. From isolated villages in Nicaragua to mountain towns in Spain. From new residential projects in Germany to the Philippine countryside. From America to Asia and Australia.

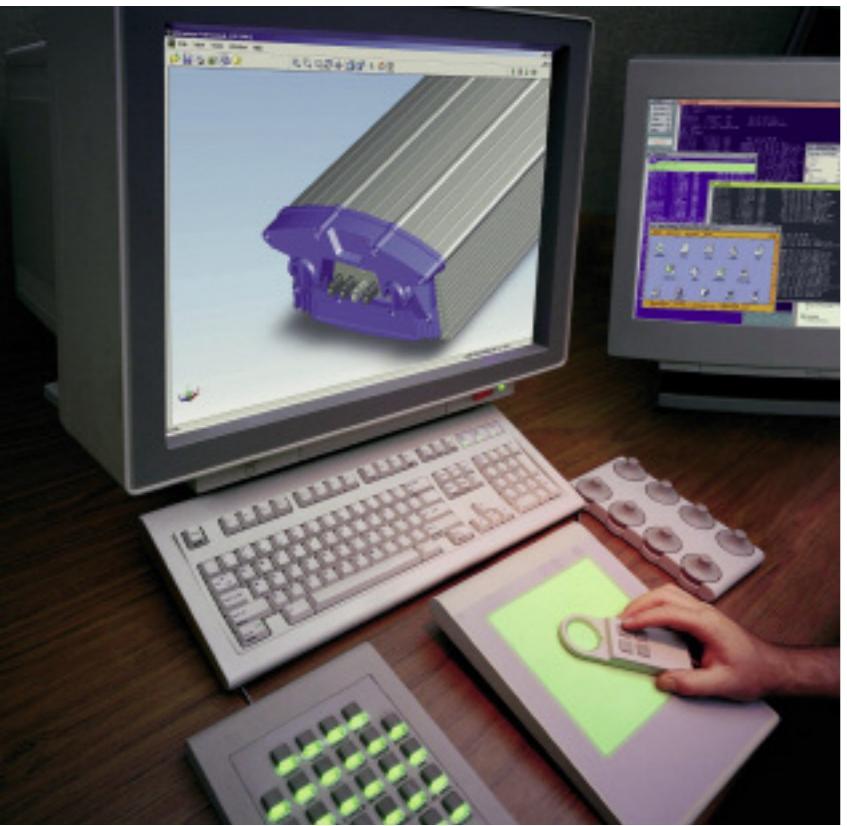
In close cooperation with local utility companies and solar module providers, Mastervolt ensures that the sun's power is used for the benefit of people. For the grid connected PV market alone, Mastervolt has an installed base of more than 250,000 solar inverters around the world.

Mastervolt technology applies international standards and conforms to national requirements. In doing so, we ensure safe operation together with utility companies and installers of on-site photovoltaic systems.

Mastervolt: **Master autonomous power systems**

Electrical power supply is the basis for development. A light allowing a book to be read at night. The power to operate a refrigerator. The benefits of Mastervolt stand-alone equipment are seen worldwide, from a bamboo house in Africa to a rural school in Central America. This is the other specialty of Mastervolt equipment: Powering rural locations without a utility grid connection.





The power of technology, development and design

Thanks to our range of high tech products, Mastervolt has become a leading A-brand in the mobile and maritime markets. And our equipment is an equally essential part of the fast-growing solar market. Every product is designed to meet the most stringent requirements. Our research and development team constantly seeks new ways to translate tomorrow's technology into improved performance today. Every part is designed to play a reliable role within an electrical power system. And a regular supply of new innovations offers increased efficiency and output. Practical experience shows the power of our approach... Mastervolt is the beating heart of countless solar energy systems.



The power of comfort and accessibility

Mastervolt equipment has proved its worth in daily practice. Each of our products sets a new standard in reliability, ease of installation and comfort. Accessible monitoring functions offer a complete overview of performance. Thanks to the small dimensions of the Sunmaster, it is easy to find a suitable place for installation. The carefully considered design with a neatly arranged LCD read-out further optimises the user-friendliness.



Clear monitoring functions

Mastervolt data control monitoring facilitates extra output for larger grid connected solar systems, for example in a housing estate. The monitoring guarantees you optimal control. Poor performance due, for instance, to shading on the roof, is quickly registered. Permanent data monitoring offers a clear insight into the output per hour, day or year.



No weak links

Vital functions are controlled with the utmost precision by powerful microprocessors. Meticulously developed control electronics protect the system from malfunctioning. Smart temperature controlled cooling fans perform their task in absolute silence. Each link in a Mastervolt system makes its own contribution to the overall reliability, sustainability and user friendliness.





Production and control in your own hands

As one of the most delicate parts of a PV system, the Mastervolt inverter or combi is responsible for numerous vital functions. These include accurate converting of DC array voltage to AC power, providing information on DC and AC output as well as volts and amps, and system security. Manufactured according to ISO 9001:2000, Mastervolt solar inverters meet the highest standards. Every product and component is thoroughly examined with an ICT computerised test before delivery.



Education and training

In addition to the quality of our products, Mastervolt's reputation for reliability is also due to a service network that offers fast local support. Thanks to a continuous education and training programme, our dealers are always up to speed with the latest developments and fully trained to safely install Mastervolt equipment. Our solar specialists are dedicated to this sector and will be pleased to offer you advice and support on any project.

The sustainable power of worldwide service and support

Mastervolt is committed to sustainable relationships as well as sustainable power. Nowhere is this more apparent than in our service and support network, which is spread across more than 50 countries. Setting up a new solar energy project? Extending or adapting an existing system? An experienced Mastervolt specialist and system adviser will be there to help you.



On-time delivery

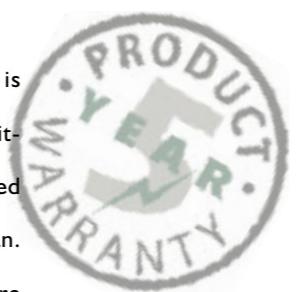
At Mastervolt, we take our obligations in terms of meeting after-sales guarantees very seriously. Our logistical approach is geared towards on-time delivery, regardless of the size of your project. In this way, we make sure that our customers can always rely on Mastervolt.





The power of 24-hour service

It is essential that power electronics equipment is completely reliable. Mastervolt underlines its commitment to this principle by offering a worldwide extended warranty on all products: The Mastervolt Guarantee Plan. Should an unsolvable breakdown occur, our experts are ready to assist you 24 hours a day. Wherever you are in the world.



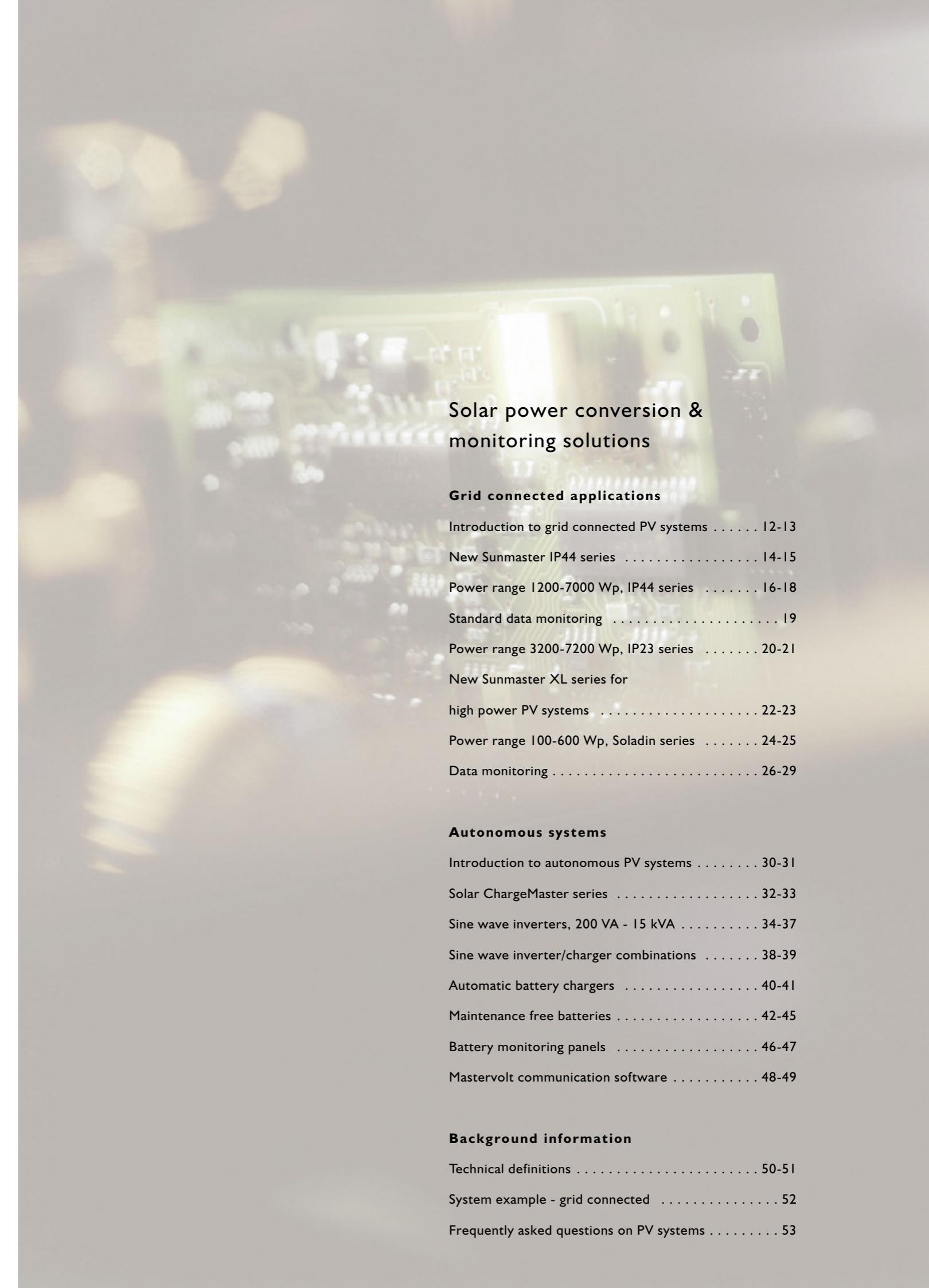
www.mastervolt.com:

Always up to date

A vital part of our communication is the extensive web site, offering accurate information about products, projects and events. Our extended support area contains literally all operating manuals, technical and commercial documents, and software.



Mastervolt solar inverters offer tailor made power for every configuration, large or small. Leading edge technology ensures that the energy supplied by solar cells is of a consistently high quality and optimally efficient. And our 'SysCalc' calculation tool means it couldn't be easier to choose the right Mastervolt inverter for your needs.



Solar power conversion & monitoring solutions

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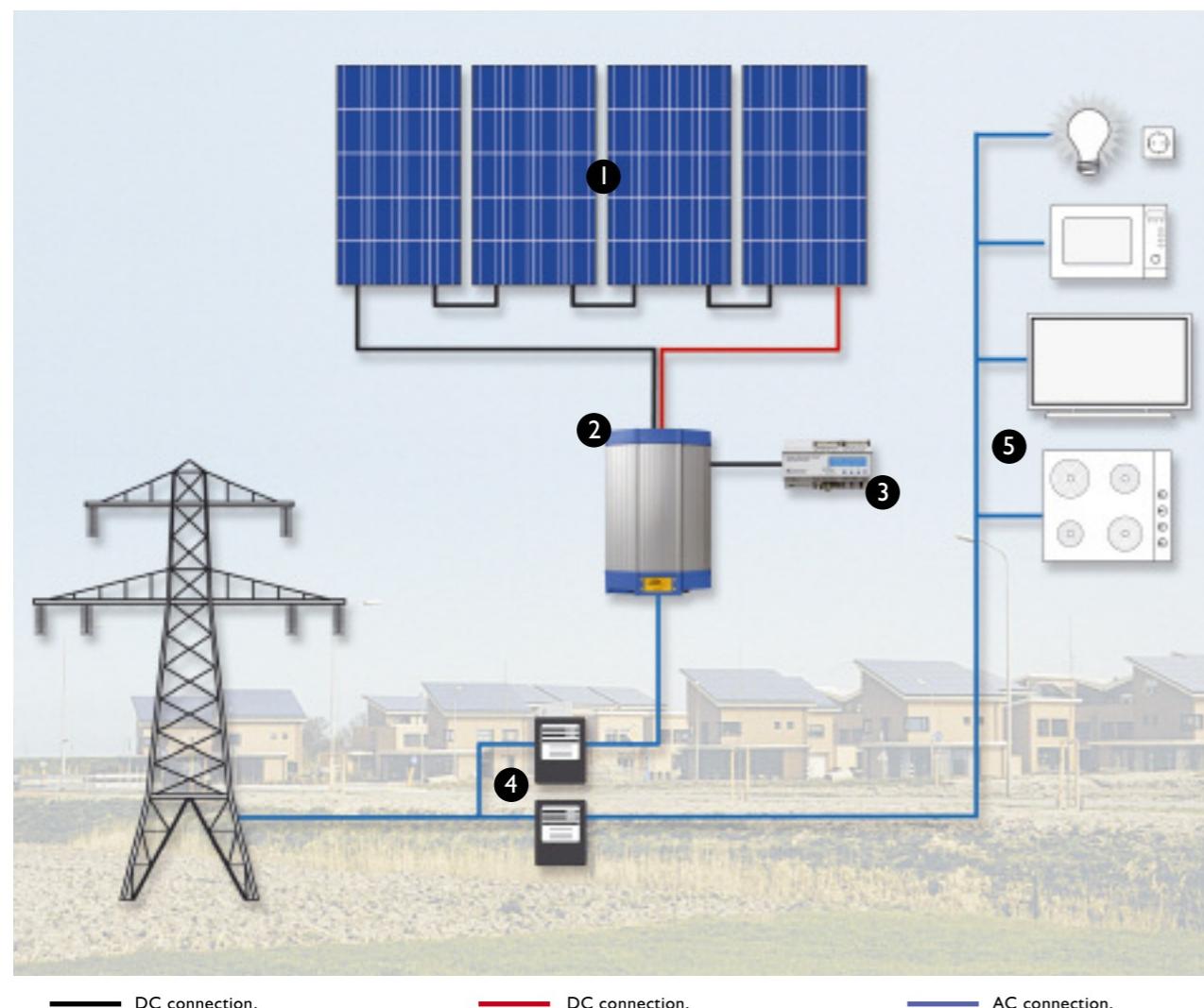
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Inverters for grid connection

The most effective and popular PV application is the connection of solar panels to the electricity network. This type of grid connected system functions as a miniature power station. Whenever the solar power production is higher than the consumption, the extra electricity is fed back into the public grid. Electricity companies pay handsomely for this kWh generation in an increasing number of countries, such as Japan, Germany, Italy, Spain, Belgium, the United States and an increasing number of countries in the Asia Pacific region.

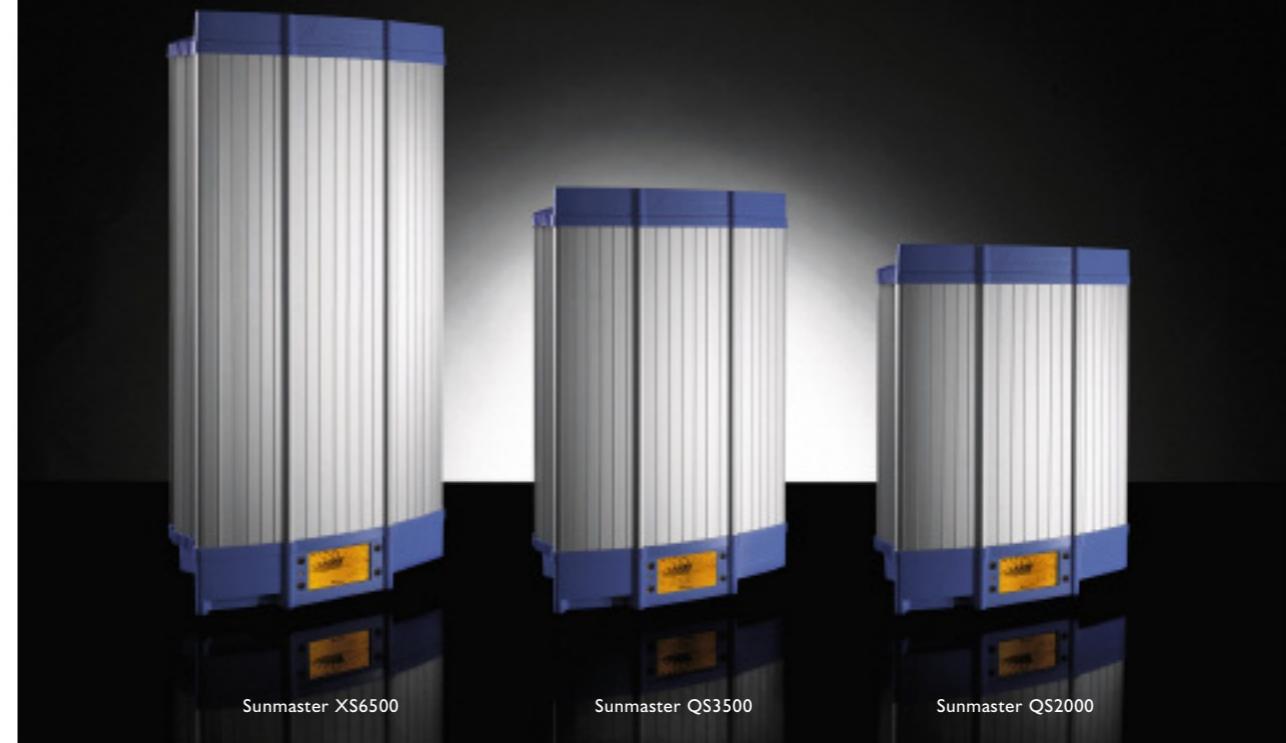
The Mastervolt inverter is the dynamic heart of any grid connected PV system. The power conversion system takes place with minimal power loss and maximum reliability, while extensive system monitoring offers accurate actual and historical data.

The products available for these applications are described on the following pages. The diagram below shows all the ingredients of a grid connected power system.



Basic equipment required for a grid connected system:

1. Solar modules (not provided by Mastervolt).
2. Mastervolt solar inverter with integrated kWh meter.
3. Mastervolt data logger for monitoring (optional).
4. A kWh meter for the registration of generated and used power (not provided by Mastervolt).
5. Energy consumers in the house (not provided by Mastervolt).



The heart of any PV system

Mastervolt solar inverters convert direct current generated by the photovoltaic strings into alternating current and feed it into the public mains. At the same time they are used for system monitoring. These extremely compact, easy-to-mount and lightweight devices offer the highest annual efficiency rates, high reliability and extensive monitoring functions.

The various models cover a performance range of 100 to 7200 Wp. PV systems with low to very high outputs can be configured flexibly: one input (Soladin 600 and QS2000), two inputs (QS3500 and XS6500), three inputs (XL10 and XL15) or even four inputs (QS6400) with independent MPP trackers are available to which two module strings of the same design can be connected. In addition, two-phase feeding into the mains above 5 kW is possible with the QS6400.

On the output side the devices can be connected in parallel in any desired combination and number. The standard models convert string currents from 7.5 A up to 30 A and string voltages from 100 to 600 V DC per input with MPP control. The models QS3500 and QS6400 Max-I, especially designed for high-current modules, convert 10 A and 75 to 260 V DC.

Industry leading benefits

Mounted in robust aluminium cabinets and designed for use in closed rooms, our inverters convert power with the latest high-frequency technology.

There are numerous advantages:

- Exceptional efficiency offers high yield scores (even in the partial load range) and minimal standby and night consumption.
- The complete electronics for power conversion fits on a single or double circuit board, hence the compact design.
- The cooling requirement is low; cooling is effected by temperature-controlled and maintenance-free ventilators.
- The output voltage only slightly deviates from the pure sine wave shape of the grid (THD <3% at nominal load).
- The galvanic isolation in the high frequency transformer between DC input and AC output ensures optimised system safety.

A high capacity microprocessor precisely regulates all inverter functions, measures all output data and monitors the correct functioning of the inverter, the connected photovoltaic strings and the power grid. The respective data can be shown on an optional display or via the integrated communication interfaces.

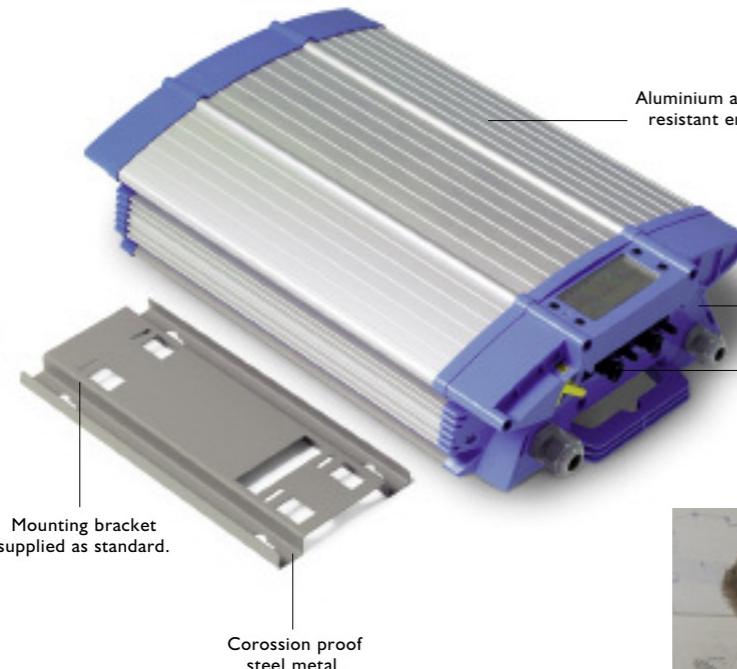
Mastervolt solar inverters comply with international standards. Country-specific models are supplied with the respective nationally approved anti-islanding safety equipment in case of power failure: in most countries the QS anti-islanding will comply. For Germany and Austria we deliver the QS solar inverters as ENS models in full compliance with VDE 0126-1-1. In addition, various safety circuits prevent damages or failures caused by incorrect operating conditions.



The new Sunmaster IP44 series : the new generation of compact, easy to install, high performance grid connect inverters from Mastervolt

With the new Sunmaster IP44 series efficiency and optimum power output are guaranteed even in the most arduous of locations. The IP44 waterproof enclosure allows for installation in most protected outdoor areas. Once connected to the PV modules in your system the low weight inverter delivers the power! Both on a bright midsummer day when it's 40 °C or more and on a cloudy winter morning. Sometimes even in bright moonlight!

Our world proven HF transformer technology is as ever built in to a compact housing, making installation simple and quick. Integrated heavy duty DC load switching adds to greater safety and simplicity in use - this comes standard on all ENS versions. Mastervolt is proud to offer you yet another innovative product with the introduction of a new and advanced LCD display with miniature data logger - storage of data for up to 30 days - giving you the profitable facts. No more guesswork.

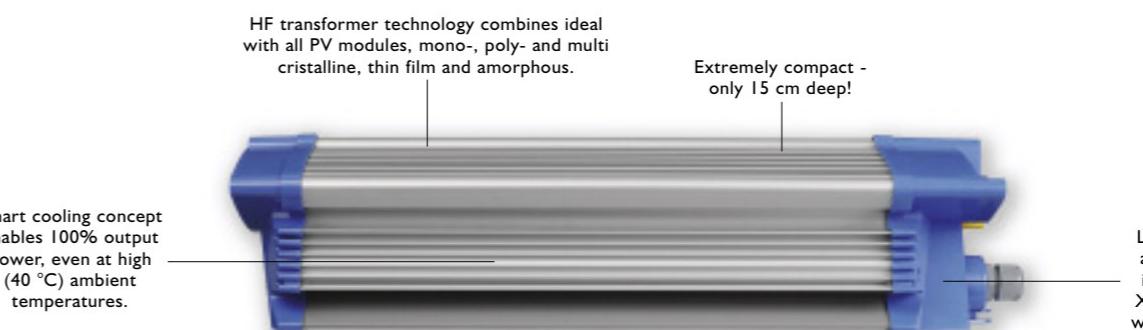
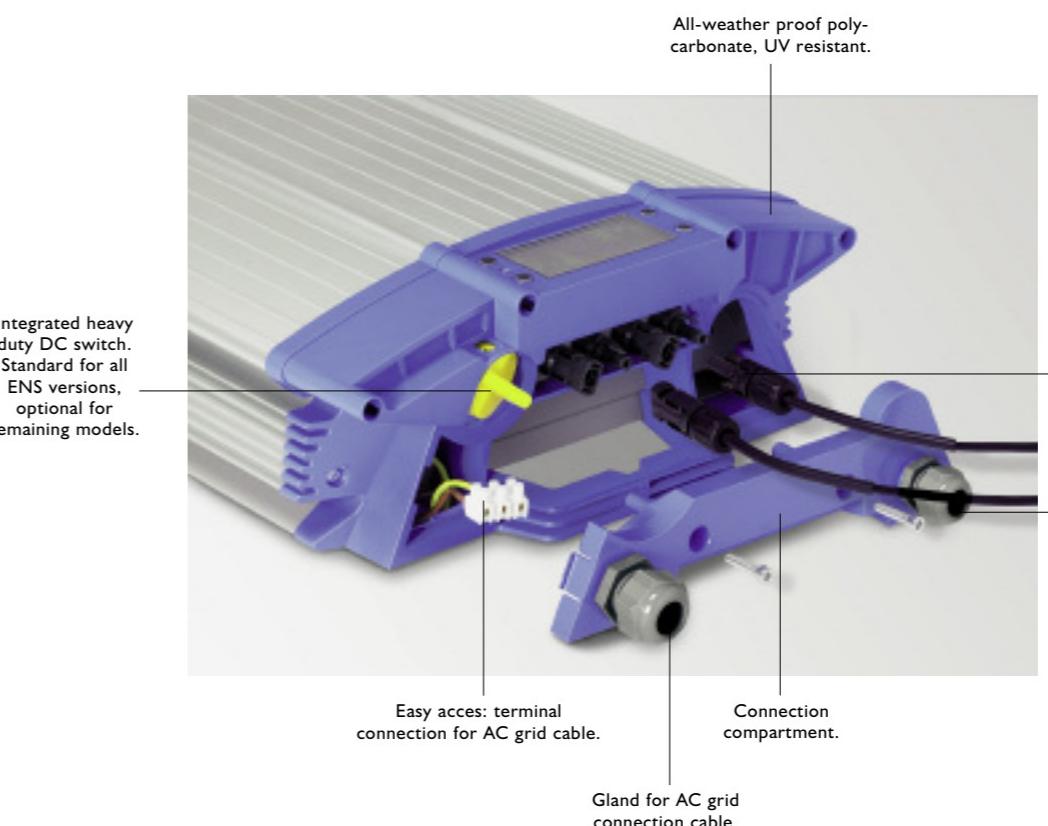
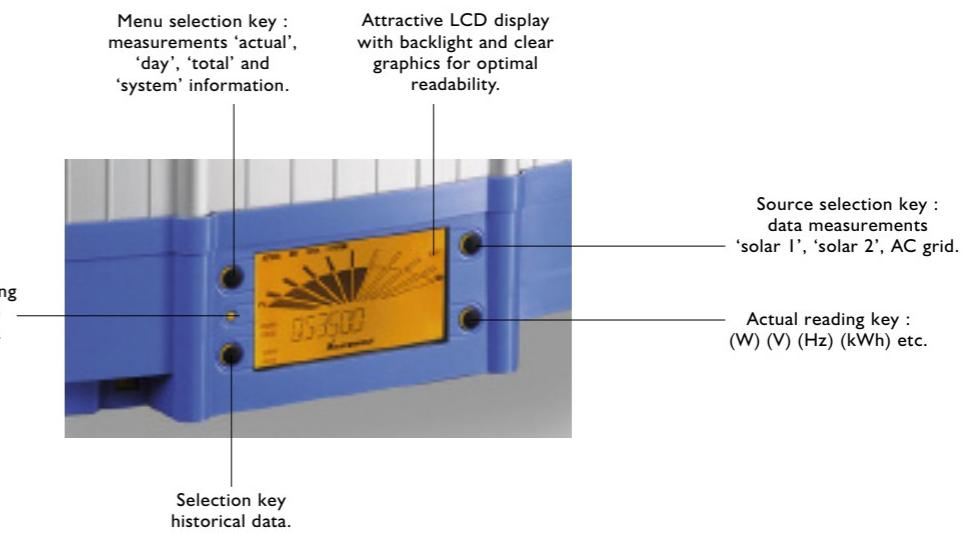


Sunmaster IP44 range

- Sunmaster QS2000
- Sunmaster QS3500
- Sunmaster QS3500 Max-I
- Sunmaster XS6500 offering 5 kW cont. output

"I have been focused on further integrating the various functions of the Sunmaster grid connected solar inverter. The new Sunmaster IP44 range is the result of this process, with a wider application (now also suitable for protected outdoor use !), user friendliness, smarter connections and a stunning read-out facility. This is one of my best designs so far".

Industrial Designer Rob van Opdorp



Sunmaster IP44 product specifications



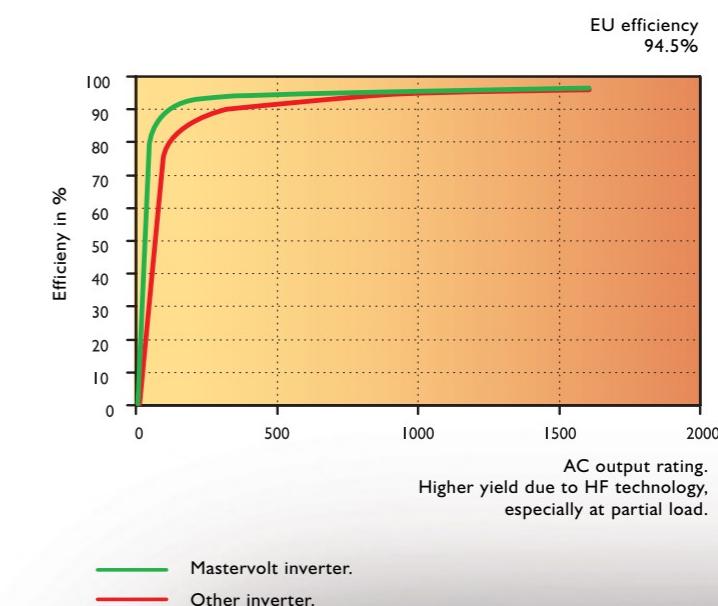
	QS2000 IP44	QS3500 IP44	QS3500 Max-I IP44	XS6500 IP44
Article number	I30802000	I30803500	I30903500	I31006500
GENERAL				
Typical string length	5 to 9 modules of 72 cells, 7 to 12 modules of 54 cells or 10 to 18 modules of 36 cells	4 to 6 modules of 72 cells, 6 to 9 modules of 54 cells or 8 to 12 modules of 36 cells	12 to 25 modules of 36 cells, 7 to 17 modules of 54 cells or 6 to 12 modules of 72 cells	
Operating temperature	-20 to 70 °C	-20 to 70 °C	-20 to 70 °C	-20 to 70 °C
Storage temperature	-20 to 70 °C	-20 to 70 °C	-20 to 70 °C	-20 to 70 °C
Relative humidity	max. 95% not condensating; PCB has anti-moisture coating			
Protection degree	IP44	IP44	IP44	IP44
Safety degree	Class I	Class I	Class I	Class I
Galvanic isolation	Class II	Class II	Class II	Class II
Dimensions (hxwxd)	471 x 356 x 145 mm	545 x 356 x 145 mm	545 x 356 x 145 mm	725 x 356 x 145 mm
Weight	6 kg	11 kg	11 kg	15 kg
SOLAR INPUT (DIRECT CURRENT)				
Nominal power	1700 W DC	2750 W DC	2750 W DC	5250 W DC
PV power range	1200 to 2100 Wp	2000 to 3600 Wp	2000 to 3600 Wp	4500 to 7000 Wp
Maximum output	1800 W	2950 W	2950 W	5600 W
MPP tracker*	1 MPP tracker	2 MPP trackers	2 MPP trackers	2 MPP trackers
MPP voltage range	100 to 380 V DC	100 to 380 V DC	75 to 260 V DC	180 to 480 V DC
Maximum voltage	450 V DC	450 V DC	325 V DC	600 V DC
Nominal rated current	7.5 A	2x 7.5 A or 1x 15 A	2x 10 A or 1x 20 A	2x 15 A or 1x 30 A
Start-up power	2 W	4 W	4 W	8 W
String connections	1	2x 1	2x 1	2x 1
DC connector	MultiContact connectors or glands + PCB spring terminals, 4 mm ²			
GRID OUTPUT (INVERTER)				
Voltage	230 V AC (184 to 265 V, depending on model), single phase			
Nominal output at 45 °C	1600 W	2600 W	2600 W	5000 W**
Maximum output	1725 W	2750 W	2750 W	5250 W**
Maximum current	8 A	13 A	13 A	25 A
Frequency	50 Hz (48 to 52 Hz, depending on model/setting)			
Power factor	0.99	0.99	0.99	> 0.99
Harmonic distortion (THD)	<3% at rated load; in compliance with IEEE p929			
Standby power	0 W	0 W	0 W	< 0.5 W
European efficiency	94%	94%	94.5%	95%
Maximum efficiency	95%	95%	95%	96%
AC connection	PG 13.5 gland + screw terminals, 2.5 to 4 mm ²			

* Dynamic; two string connections each are connected in parallel.

** In Germany 4600 W, single phase.

Extremely efficient - up to 25% more yield

As a result of the advanced switch mode technology applied, Mastervolt solar inverters have negligible power loss in the DC to AC conversion process, resulting in a much higher AC power return to the grid. Even at 5% of nominal power the inverter realizes more than 90% efficiency. The maximum efficiency is almost 95% which is extremely high considering the input to output galvanic isolation.



Sunmaster IP44 product specifications

SAFETY DEVICES	
General	galvanic separation between DC and AC side, by means of a class II HF transformer
Island protection	<ul style="list-style-type: none"> ENS models : redundant impedance, voltage and frequency window monitoring; independent switch off by two pole relay and solid state switch; VDE V 0126-I-1:2006 compliant. QNS models: redundant voltage and frequency window monitoring; independent switch off by two pole relay and solid state switch. UK models: software-controlled frequency adjustment according to G83.
Temperature protection	power derating at $T_{\text{ambient}} > 40^{\circ}\text{C}$; switch off at $T_{\text{indoor}} > 90^{\circ}\text{C}$
DC side protection	<ul style="list-style-type: none"> earth fault detection over-voltage detection polarity protection (diodes) current limitation transients (varistor and buffer capacitor) overload (temperature controlled power derating)
AC side protection	<ul style="list-style-type: none"> current limitation over and undervoltage over and underfrequency short circuit (ceramic fuse) transients / surge (varistors)
Reclosure time	10 to 300 s (model dependent)
MONITORING	
On the front	integrated LCD display
External communication	two RS485 connections to connect to the QS databus
Optional monitoring accessories	<ul style="list-style-type: none"> Data Control Basic: software for PC QS PC-Link: PC adapter for QS databus Data Control Premium II: data logger and PC local/remote monitoring/internet connection Data Control Professional : data logger and PC local/remote monitoring/internet connection using current weather data or optional sensors
REGULATIONS & DIRECTIVES	
CE conformity	yes
EMC directive	EMC 89/336/EEC
Emission	EN 50081-1, EN 55011, EN 55014, EN 55022, VDE 0871 class B
Harmonics	EN 61000-3-2, IEEEp929, Flicker:61000-3-3
Immunity	EN 50082-2
LV directive	73/23/EEC
Electrical safety	EN 60950 / ENS:VDE 0126 / UK: G83-2003 certification

Basic monitoring as standard

The Mastervolt communication modules offer a flexible, reliable and user-friendly possibility to permanently monitor your grid-connected photovoltaic system, also from a remote location. This ensures a constant overview of the solar power yield and all important system data. When a value is no longer within the specified limits, you can quickly take corrective actions. External energy counters are not required. The modules Data Control Basic, Data Control Premium II and Data Control Pro offer different functional possibilities extending from the display of the current systems data on the optional display to the web-based remote monitoring and visualisation.

Data Control Basic (standard for the Sunmaster range)

Every Sunmaster model comes as standard with an integrated RS485 communication interface and a ten-day power output memory. This makes the entire PV system interactive, with the option of reading the most essential information using your PC or laptop. All that is required to connect the Sunmaster with your computer is a communication cable and PC link (adapter plug).

The software for reading out the data under Microsoft Windows is available free of charge in the Download & Support section of our website under www.mastervolt.com.

The Data Control Basic programme gives a schematic overview of the PV system's performance, including:

- Power and operational hours over a ten-day period.
- Voltage, current and load of the solar panels (current values).
- Voltage, current and frequency of the 230 V grid (current values).
- Internal temperature, total power (kWh), total hours of operation.
- Read out of the number of returned amperes (output side).
- Grid voltage, current and frequency (output side).
- Read out of the temperature of the Sunmaster, total output in kWh, status of operational hours.
- Current status and error messages.

For our extended monitoring program see page 26 to 29.



Basic monitoring via the PC,
Data Control Basic-Software.



PC-Link (optional),
art. no. 130391010.



Sunmaster QS6400 IP23 product specifications



QS6400



QS6400 Max-I

Generic article no.	130606400 see the Mastervolt price list for the specific country versions and article numbers	130706400
GENERAL		
Typical string length	5 to 9 modules of 72 cells, 7 to 12 modules of 54 cells or 10 to 18 modules of 36 cells	4 to 6 modules of 72 cells, 6 to 9 modules of 54 cells or 8 to 12 modules of 36 cells
Operating temperature	-20 °C to 50 °C, protected against high temperatures	
Storage temperature	-20 °C to 70 °C	-20 °C to 70 °C
Relative humidity	max. 95% not condensing; PCB has anti-moisture coating	
Protection degree	IP23	IP23
Safety class	class I	class I
Galvanic isolation	class II	class II
Dimensions (hxwxd)	476 x 315 x 254 mm	476 x 315 x 254 mm
Weight	14 kg	14 kg
SOLAR INPUT (DC)		
Nominal power to 40 °C ambient temp.	5500 W or 4870 W DC*	5500 W or 4870 W DC*
PV power range	3200 to 7200 Wp	3200 to 7200 Wp
Maximum DC power	5900 W	5900 W
MPP Tracker (dynamic)	4 MPP trackers	4 MPP trackers
MPP voltage range	100 to 380 V DC	75 to 260 V DC
Maximum voltage	450 V DC	325 V DC
Nom. rated current	4x 7.5 A or 2x 15 A	4x 10 A or 2x 20 A
Start-up power (power drawn from the solar side)	8 W	8 W
String connections	4x 2	4x 2
DC connector	glands + PCB spring terminals 4 mm ² max. or MultiContact connectors	
GRID OUTPUT (AC)		
Voltage	230 V (184 to 265 V, depending on the model), single or double phase	
Nom. AC power	5200W or 4600 W*	5200 W or 4600 W*
Max. AC power	5500W or 4600 W*	5500 W or 4600 W*
Current (fused)	2x 12 A	2x 12 A
Frequency	50 Hz (48 to 52 Hz, depending on the model)	
Power factor	0.99	0.99
THD	<3% @ rated load; in compliance with IEEE p929	
Stand-by power	0 W (DC voltage controlled relay)	
European efficiency	94%	94.5%
Maximum efficiency	95%	96%
AC connector	gland with PCB spring terminals	

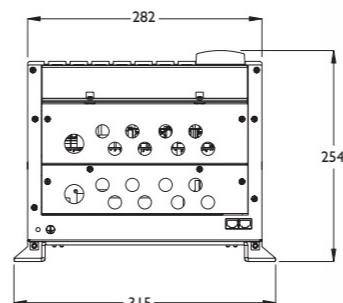
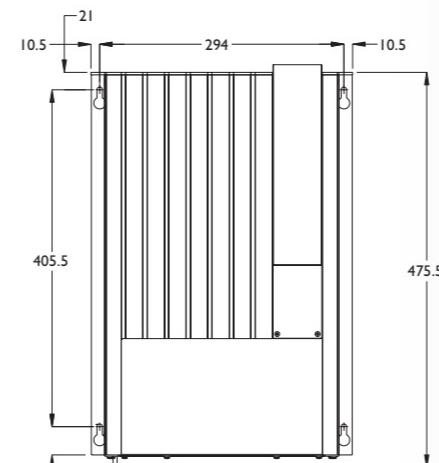
* Limited to 4600 W AC (4870 W DC) in case of ENS and one-phase feeding; two-phase feeding with 5200 W AC (5500 W DC) possible.

SAFETY DEVICES

General	galvanic separation between DC and AC side, by means of a class II HF transformer	
Island protection	<ul style="list-style-type: none"> ENS models: redundant impedance, voltage and frequency window monitoring; independent switch off by two pole relay and solid state switch; VDE V 0126-1-1:2006 compliant. QNS models: redundant voltage and frequency window monitoring; independent switch off by two pole relay and solid state switch. 	
Temperature protection	power derating at T _{ambient} > 40 °C; switch off at T _{indoor} > 90 °C	
DC side protection	• earth fault detection	• over-voltage detection
	• polarity protection (diodes)	• current limitation
	• transients (varistor and buffer capacitor)	• overload (temperature controlled power derating)
AC side protection	• current limitation	• over and undervoltage
	• over and underfrequency	• short circuit (ceramic fuse)
Reclosure time	transients / surge (varistors)	
	10 to 300 s (model dependent)	
MONITORING		
On the front	six LEDs for indication of power and system diagnosis	
External communication	two RS485 connections to connect to the QS databus	
Monitoring (optional)	<ul style="list-style-type: none"> QS display: integrated LCD (standard for ENS models) Data Control Basic: software for PC (shareware from www.mastervolt.com) QS PC-Link: to connect the QS databus to the PC Data Control Premium II: datalogger and software with telephone and modem dial-up facilities Data Control Professional: datalogger using meteo data from the internet 	

Certificates

All Sunmaster solar inverters have been approved by local authorities, which is an indispensable guarantee for safe and reliable functioning. The certificates in the Download & Support Area of our www.mastervolt.com website represent some of the documents we have obtained, allowing trouble-free use in the United Kingdom, Germany, the Netherlands, Denmark, the Scandinavian countries, Spain, France, Italy, Greece, Cyprus and Korea.



Dimensions QS6400 and QS6400 Max-I, in mm.



New Sunmaster XL series for high power PV systems



The most recent development is a new high power solar inverter with a power rating between 10 and 15 kW AC.

The new Sunmaster XL models are delivered in a waterproof IP55 enclosure which can be installed in either a grid connected solar tracker system or a stationary PV system. The inverter consists of three highly efficient switch mode power modules of 3.3 or 5 kW power rating each, dependent on the model.

The unit has an operating DC voltage window of 100-600 V DC. Galvanic isolation is provided by class II high frequency transformers.

The output voltage is 230 V AC three-phase, 50 Hz. Islanding protection is foreseen according to local standards. Extended diagnostics and remote monitoring is delivered as a standard.



Mastervolt Guarantee Plan • 5-year product warranty • worldwide service • 48-hour replacement service

Sunmaster XL product specifications

GENERAL SPECIFICATIONS

Description	integrated 3-phase solar inverter, consisting of one IP55 Outdoor enclosure and 3 power modules. Enclosure and modules to be shipped separately.	
Operating temperature	-20 °C to 60 °C ambient, full power up to 45 °C ambient air temperature, derating -3%/°C above 45 °C	
Protection degree	IP55 enclosure (PCB protected against humidity and condensing air by coating)	
Safety class	class I (metal housing with earth connection)	
Galvanic isolation	class II (safety transformer)	
Weight	135 kg (96 kg enclosure + 3x 13 kg modules)	
Dimensions (hxwxd)	1200 x 580 x 480 mm (with legs: 1408 x 638 x 480 mm)	
Connections	power module: DC input is fitted with MC2/4mm connectors / AC output fitted with 100 cm AC cable / 2 RS485 communication ports. Enclosure: mounting positions prepared for 2x 50 cm DIN rail (not included).	

SOLAR INPUT (DC)

	Model XL10	Model XL15
Recommended PV power range	9 to 13 kWp	14 to 20 kWp
Maximum input power	11.200 W DC	16.800 W DC
Continuous power @ 45 °C	10.650 W DC	15.975 W DC
Start-up power	3x 10 W	3x 10 W
Operating voltage	100 to 550 V DC; nominal 400 V DC	100 to 600 V DC; nominal 400 V DC
MPP voltage range @ nom. power	180 to 480 V DC	180 to 480 V DC
Maximum voltage	600 V DC	600 V DC
Number of inputs	3	3
Rated current	3x 15 A	3x 30 A
MPP tracker	3 MPP trackers with 99,9% MPP efficiency (Fraunhofer algorithm)	
DC connectors	6 Multi Contact II connectors	6 Multi Contact II connectors

GRID OUTPUT (AC)

Voltage	230 V AC three phase	230 V AC three phase
Power	10.000 W nominal / 10.500 W maximum	15.000 W nominal / 15.750 W maximum
Nominal current	3x 15 A	3x 22 A
Frequency	50 Hz models: 48 to 52 Hz programmable / 60 Hz models: 57 to 63 Hz programmable	
Power factor	> 0,99 at full power	> 0,99 at full power
Harmonic distortion	THD < 3% at full power	THD < 3% at full power
Stand-by power	< 5 W	< 5 W
Efficiency	EU: 95% @ Unom. / maximum 96%	EU: 95% @ Unom. / maximum 96%
AC connector	AC and DC glands on detachable plate in bottom of connection compartment. Power modules supplied with 3x 4 mm ² cable. DIN rail, connection equipment, fuses, terminal blocks etc. not included.	
Fuse	Internal PCB fuse in power modules	Internal PCB fuse in power modules

SAFETY DEVICES

General	galvanic separation between DC and AC side by means of class II HF transformers
Island protection	An AC fault in any of the phases will disable all three power modules. Redundant voltage and frequency window monitoring (QNS). Independent cut-off by means of 2 pole relay and solid state switch (ENS) according to VDE 0126-1-1:2006.
Safety devices DC side	• DC-to-earth isolation resistance monitoring • DC over-voltage detection (LED warning and switch off) • DC inverse polarity protection (diodes) • DC current limiting by up-shifting operating voltage • transients (varistors and buffer capacitor) • overload (power limiting and temperature controlled power derating)
Safety devices AC side	• AC current limiting • DC current injection protection • short circuit (ceramic fuse) • transients / surge up to 4 kV (varistors)
Reclosure time	wait 10 to 300 s (model dependant) after AC grid fault

SYSTEM INFORMATION / DIAGNOSTICS / COMMUNICATION

User interface	6 status LED's on each power module
External communication	2 surge protected RS485 connections. Max. 10 XL units can be connected to 1 Data Control Pro datalogger.

REGULATIONS AND DIRECTIVES

CE Conformity	yes	EMC Directive	EMC 89/336/EEG
Emission	EN 55022	Harmonics	EN 61000-3-2, IEEE 1547
Dips, variations, flicker	EN 61000-4-11 ; EN 61000-3-3	Immunity	EN 61000-6-2
LV directive	73/23/EEG	Electrical safety	EN 60950
Anti-islanding	VDE 0126-1-1:2006		



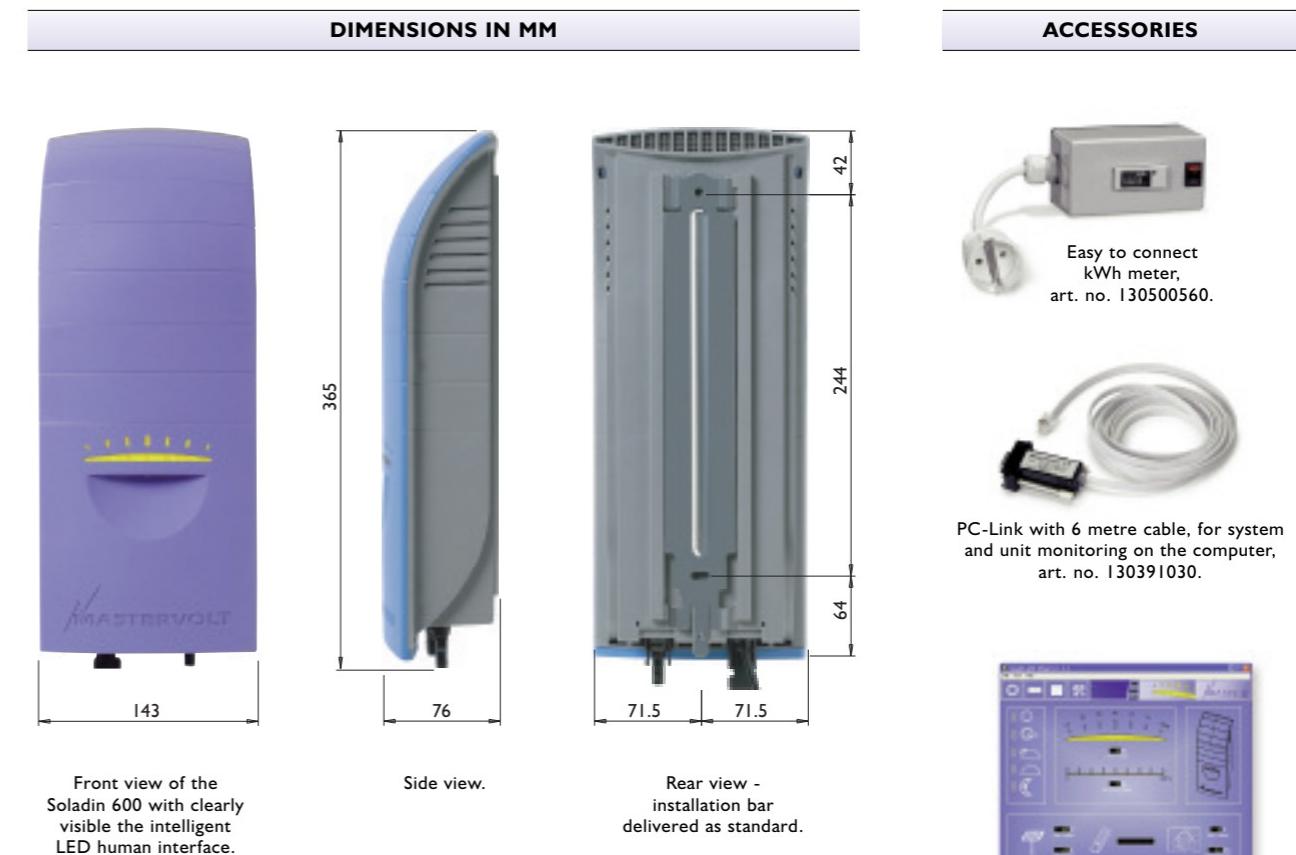
Soladin 600 & Windmaster 500 product specifications*

Article no. Soladin 600 (solar energy)	I30000600 (Italy: I30000610 / Spain: I30000620 / UK: I30000630)
Article no. Windmaster 500 (wind energy)	I40000500
GENERAL	
Work temperature / storage temperature	-20 °C to 40 °C / -20 °C to 70 °C
Relative humidity	max. 95% not condensing
Protection degree / safety class	IP23 / class II
Dimensions (hxwxd)	365 x 143 x 76 mm
Weight	2 kg
Casing	plastic (ABS)
SOLAR INPUT (DC)	
Power	535 W nominal / 600 W maximum
PV power	160 to 700 Wp
MPP voltage	40 to 125 V DC
Maximum voltage	155 V DC
Nom. rated current	8 A
Starting up power	1 W DC @ 40 V DC
DC connection	MultiContact 4 mm
GRID OUTPUT (AC)	
Voltage	230 V (184 to 265 V, programmable)
Maximum power	2.25 A
Fuse	3.15 A slow
Frequency**	50 Hz (49.8 to 50.2 Hz)
Cos phi	0.99
Zero load	<0.05 W AC
European output / max. output	91% / 93%
AC connection	Euro socket
READ OUT FUNCTION	
Indicator	two LEDs, yellow and red
Correct working	flashes yellow (speed of flashing is in relation to the power generated)
Malfunction grid or inverter	red (6 different flashing codes)
PROTECTIONS	
Island protection:	monitoring of voltage and frequency frame, disconnects within 100 ms. ENS not available.
Protection of peak capacity:	automatic control, dependent on the temperature of the converter, by raising the Vmpp. It is impossible to damage the converter with too much power.
Temperature protection:	reducing the power in case of a higher temperature of the converter, will disconnect above 80 °C.
DC polarity protection:	DC connection is protected (MC connectors can be damaged).
NORMS	
CE	yes
EMC guideline	EMC 89/336/EEC
Emission	EN 50081-1
Harmonisation	EN 61000-3-2
Immunity	EN 50082-2
LV guideline	LV 73/23/EEC
Safety	EN 60950

* Products developed for countries where an ENS circuit is not required. Fitted with QNS anti-islanding as standard.

** UL versions not available. 240 V/60 Hz available upon request.

Sun & Wind applications



Data monitoring : Data Control Premium II

As a follow-up to the successful 'Premium' model for medium-sized systems, the new Premium II offers numerous new functions and an extended operating range. Based on the Data Control Professional concept, it provides a functional scope previously only found in extremely large systems. Professional quality at a reasonable price : A unique offer!

Versions

Two Premium II versions are available for different fields of applications.

Premium II Local with incorporated Ethernet (network) interface.

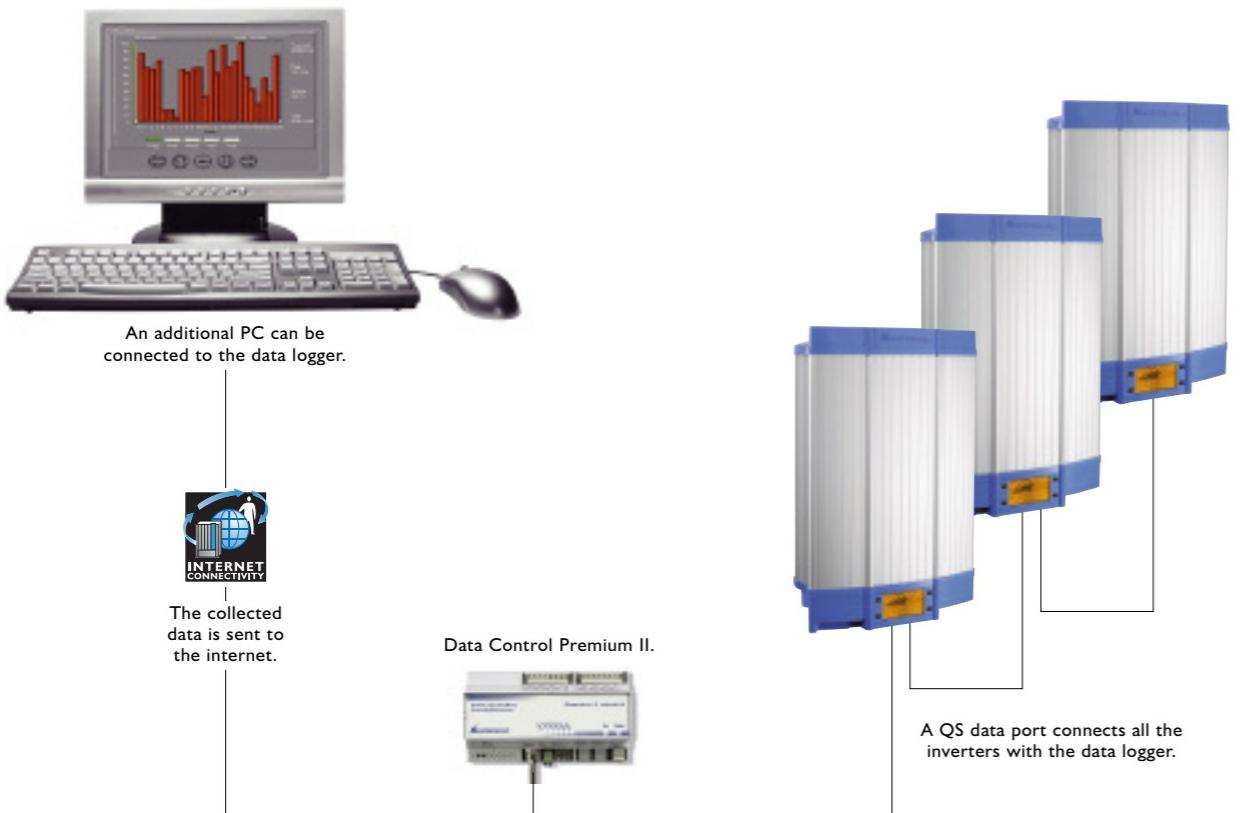
Applications:

- Data transmission to PC/port, directly or via network/evaluation via Premium II PC software.
- Data transmission via internet with the existing ADSL connection/evaluation via the Mastervolt portal.

Premium II Remote with integrated analogue modem.

Applications:

- Remote data transmission to PC, evaluation via Premium II PC software.
- Remote data transmission via the Mastervolt server, evaluation via the Mastervolt portal.



Interfaces

All inputs and outputs you may wish for are included as standard:

- QS Databus interface for six QS inverters or 30 kW maximum.
- Analogue input (0-10V) for irradiation sensor (Mastervolt temperature-compensated sensor available as option).
- Digital input for kWh counter.
- Digital output for alarm connection or large-size display.
- Integrated power pack.
- Ethernet port (Premium II Local).
- Telephone connection for integrated analogue model (Premium II Remote).

Data registration

A QS data interface connects all inverters with the Premium II data registration unit. Up to six inverters can be connected. The Premium II data logger continuously communicates with all connected inverters and saves all current measured values and system data every 10 minutes. The device offers a large data memory for values measured over a period of up to three years (depending on the configuration).

Specifications Data Control Premium II

Data registration module for Sunmaster QS and XS systems.



Premium II Local (Ethernet)



Premium II Remote (Modem)

Article number	130396000	130396100
HOUSING		
Dimensions (hxwxw)	90 x 160 x 73 mm (6 TE)	90 x 160 x 73 mm (6 TE)
Installation	hat rails	hat rails
Mode of protection	IP20	IP20
Temperature range	0 °C to 55 °C	0 °C to 55 °C
VOLTAGE SUPPLY		
Power pack 230 V	internal	internal
Voltage supply (sensors)	yes, 24 V	yes, 24 V
INPUTS / OUTPUTS		
Analogue (irradiation)		
Digital (kWh counter)		
Outputs (alarm, large-size display)		
INTERFACES / COMMUNICATION		
RS485 (QS Databus)	(6 WR / 30 kW)	(6WR / 30 kW)
Ethernet (network / PC)		-
Modem (analogue)	-	
DATA READOUT		
Internet portal	yes	yes
PC software	yes	yes
ALARM FUNCTION		
E-mail (via network)	yes	yes
SMS	no	yes
Fax	no	yes
Visual	yes	yes
Acoustic	option	option

Recorded values

In addition to energy, irradiation and operating hours numerous additional measured values are recorded:

- Energy yield and operating hours.
- Total energy yield and total operating hours (since commissioning).
- Voltage, current and power output of the connected solar modules.
- Voltage, current, frequency and impedance of the 230 V mains.
- Current internal temperature of the inverter.
- Power currently supplied to the mains.
- Serial number, communication address, inverter number.
- Current status and fault messages (e.g. overvoltage, ENS switch off, over-temperature).

The cause of any failure can be easily determined and the fault remedied with the additional operating data. With Premium II

Remote, installers can dial in via an internet or modem connection and assess in advance what has to be done.

Evaluation

Data inquiry and evaluation is via a PC. The connection to the Data Control Premium II Local is optionally established via direct or network connection. The Premium II Remote can be optionally evaluated via the data telecommunication (modem) connection or worldwide via the Mastervolt Internet Portal. Five years free access to the Mastervolt Internet Portal is included in the price. There is only an initial charge payable for setting up your system in the portal.

Monitoring/alarm function

Email, fax, SMS, visual, acoustic (optional).

The connected inverters are automatically detected.

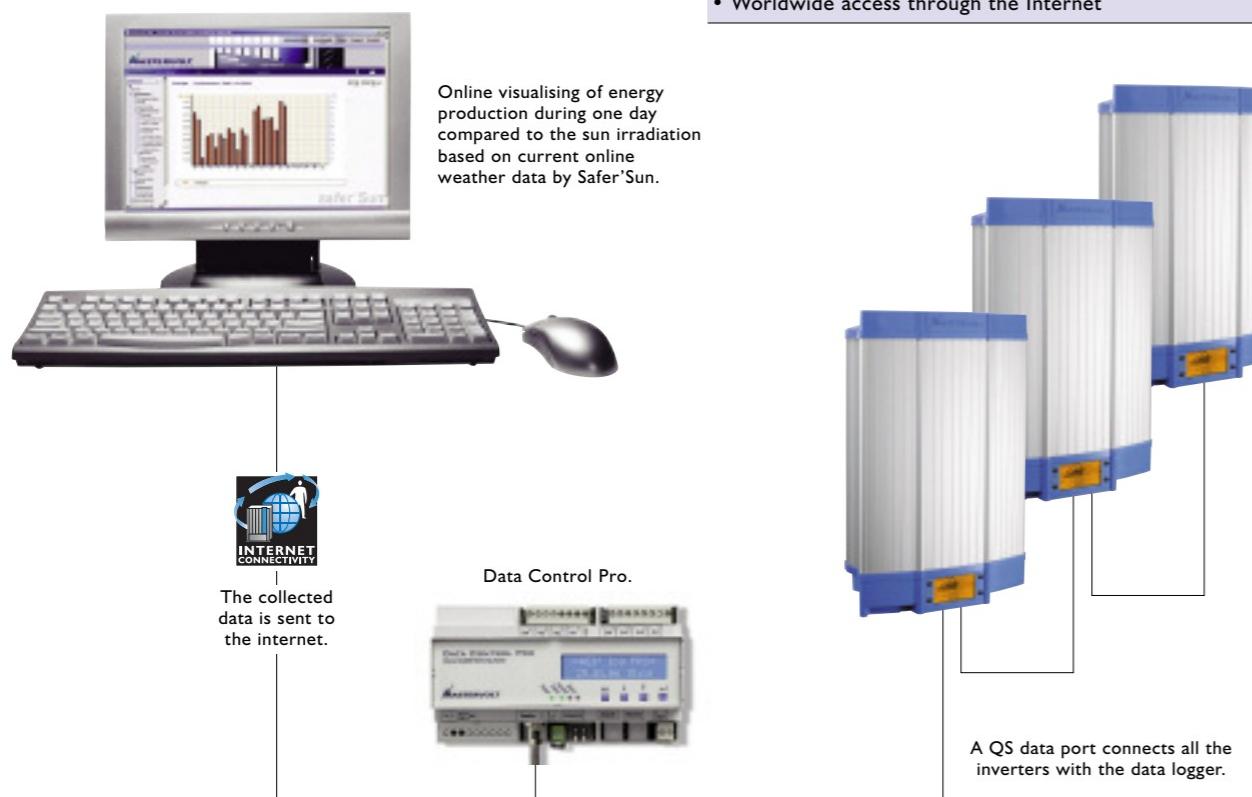
Internet data monitoring : Data Control Pro

The Data Control Professional data logger provides monitoring, read outs and alarm warnings via the internet. During the day, the data logger extracts information on power output directly from up to 20 Sunmaster inverters via the QS data port. This eliminates the need for external kWh meters. Overnight, the collected data is sent to a web page, from which it can later be accessed from anywhere in the world using a log in code. Exceptionally accurate weather prediction data is used to assess the output of the PV system. An important advantage of the system is the link from the local monitoring to the weather registration of Meteodata in Germany. An external reference cell is not required.

Should the Sunmaster inverters report a system fault or the solar yield not conform to the expected specified value, an alarm routine of the Safer Sun Programme is activated. According to the settings, an alarm is triggered on site at the device itself or a warning message is sent by email, fax or SMS. This superior monitoring method ensures a high availability of the recording device, which in turn enables a large number of systems to be monitored.

Data Control Pro specifications

Data logger Data Control Pro			
Integrated modem	analogue	ISDN	GSM
Art. no. 1303.96.2xx	xx = 00	xx = 10	xx = 20
INTERFACES			
Input analogue	4 (0 to 20 mA, 0 to 10 V)		
Input digital	4 (meters / status)		
Bus connection	1 (RS485)		
Internet connection	Ethernet		
Alarm output	24 V DC / 230 V AC, 2		
ELECTRICAL DATA			
Grid connection	230 V AC		
Power	2 W (max.)		
MECHANICAL DATA			
Dimensions (hxwxw)	90 x 160 x 73 mm		
Mounting	hat rail mounting		
Protection degree	IP20		
ENVIRONMENTAL CONDITIONS			
Operating temp.	0 °C to 55 °C		
Storage temp.	-20 °C to 65 °C		
Data logger	all current measured values and system data of the inverters		
MINIATURE WEB SERVER			
Data recording and evaluation with Safer'Sun:			
• Automatic daily data recording with high resolution			
• Evaluation per day, month and year			
• Graphic data display			
• Alarm messages via fax, SMS, email			
• Automatic comparison with the actual, regional irradiance data			
• Worldwide access through the Internet			



Data Control Pro 230 V - GSM modem,
art. no. 130396220.

Accessories Data Monitoring

Data Control Basic



PC-Link,
art. no. 130391010.



Model RS485/USB ISO,
art. no. 130391040.



Model RS485/232 converter,
art. no. 130391020.

PC-Link Industrial, for the connection of more than 10 Sunmasters or 25 mtr connection cable.

Data Control Premium II & Data Control Pro



DC Pro irradiance sensor 0 to 10 V, temp. compensated, art. no. 130394410.



DC Pro irradiance and temperature sensor 0 to 10 V, art. no. 130394400.



Data Control Pro 230 V-ISDN in enclosure, art. no. 130396310.



DC Pro ambient temperature sensor 0 to 10 V, art. no. 130394420.



Documentation CD Data Control Pro, includes user manual, installation information and drawings.



PT100 converter, art. no. 130394440.

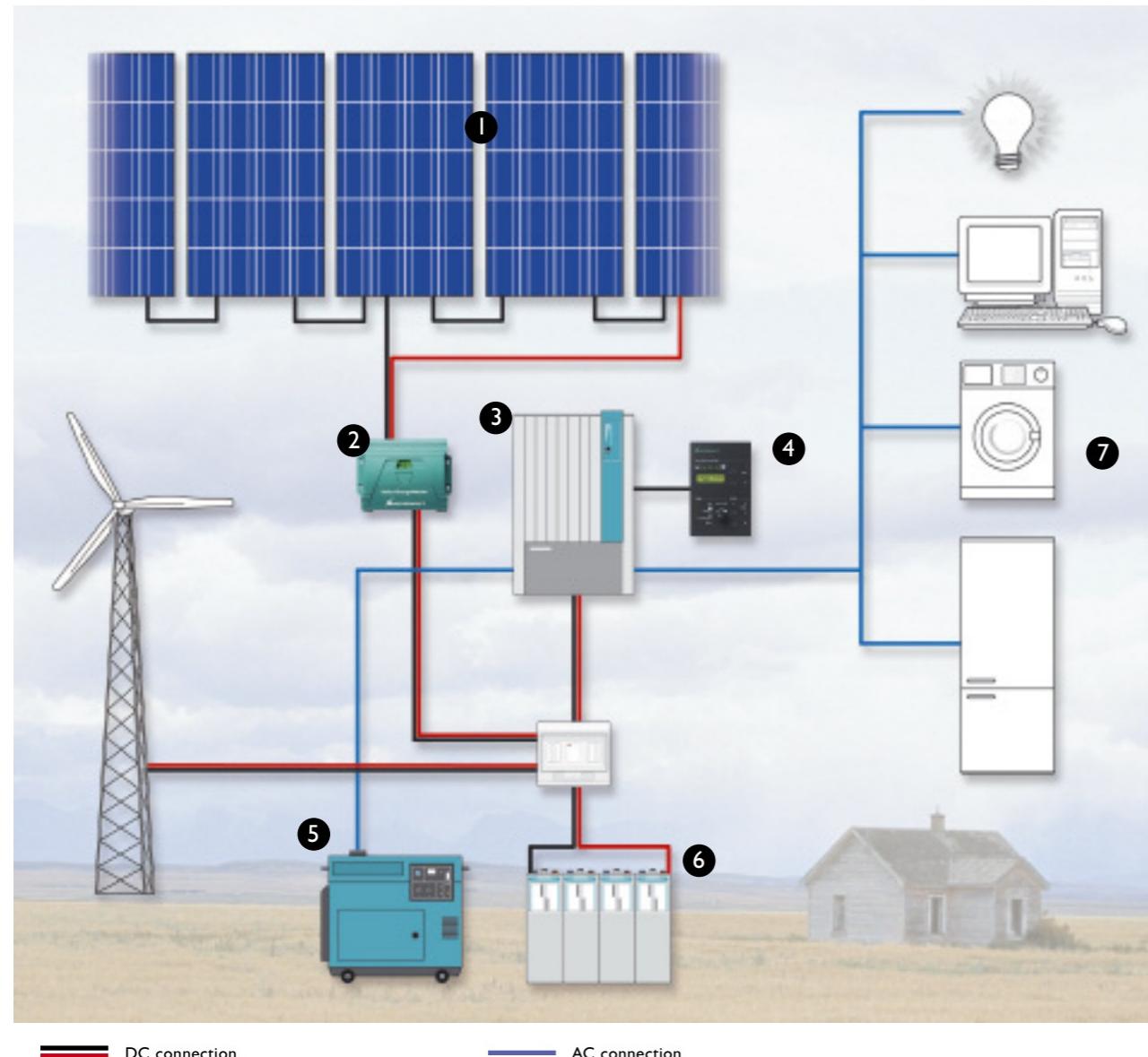
Electrical power systems for absolute independence

Solar modules are eminently suitable as a source of energy also in areas where the electricity network is unreliable or nonexistent. Any extra power generated is stored in an energy buffer - the battery - and the optional monitoring system helps keep track of power consumption.

Mastervolt offers a wide range of sine wave inverters and combis that convert raw electricity generated by PV or wind generators into a clean and stable, universally applicable AC voltage.

Mastervolt inverters and combis deliver 230 V/50 Hz or 120 V/60 Hz sine wave power for lamps, refrigerators, computers, tools, water pumps and various other appliances.

Dakar and Mass Combi models incorporate an advanced three-stage battery charger for use on cloudy days by connecting a small diesel or petrol generator. This system guarantees you genuine independence from the electricity company and ensures a high quality power supply.



Equipment needed for autonomous, grid independent systems:

1. Solar modules (not provided by Mastervolt).
2. Battery charge regulator with MPP tracker.
3. Mastervolt sine wave inverter/charger (e.g. Mass Combi).
4. System monitoring.
5. Back-up generator.
6. Mastervolt deep cycle batteries for power storage (AGM or gel).
7. Energy consumers in the house (not provided by Mastervolt).



Mass Combi inverter/charger models.

The best choice for autonomous PV systems

Mastervolt offers a wide range of highly efficient sine wave inverters and inverter/charger combinations, ranging from 250 W to 15 kW. In this brochure we have listed our Mass Sine standalone solar inverter, Mass Combi inverter/charger and the recently upgraded Dakar Combi series. All product ranges are designed to operate in harsh environments with high ambient temperatures. We also highlight our maintenance-free lead batteries and battery chargers, which are ideal for quickly and completely charging the batteries using a diesel or petrol generator.

Features:

- Switch mode technology (Mass models).
- Extremely efficient and minimal heat loss.
- Exceptionally quiet.
- Easy to mount in a central IP54 or IP65 cabinet.
- High peak power (200%) offered by a build-in soft start to handle inductive loads smoothly.
- Pure sine wave output under all load circumstances.
- Power factor corrected battery charger: accepts almost any type of generator (Mass Combi models).
- 3-Step[⊕] charge method ensures the fastest and most complete recharge.

Mastervolt Combi: Combination of functionalities

- Conversion of battery power to 230 V/50 Hz or 120 V/60 Hz sine wave power.
- Battery charging in case generator or utility power is available.
- Automatic load switching from generator or utility to inverter.
- Programmable: all system variations can be selected by MasterAdjust software.
- Energy management by means of advanced monitoring through remote panel and/or PC.
- Can be stacked to double the power.

Complete range:

- Output capacity ranging from 250 W to 15 kW.
- Available for both 230 V/50 Hz and 120 V/60 Hz.
- Available in 12, 24 and 48 V DC.
- Perfectly compatible with existing systems.
- Pure sine wave output: protection of your appliances and trouble-free operation.
- Simple and extremely safe installation.
- Available as complete system, including batteries.



Mastervolt advanced solar charge controller

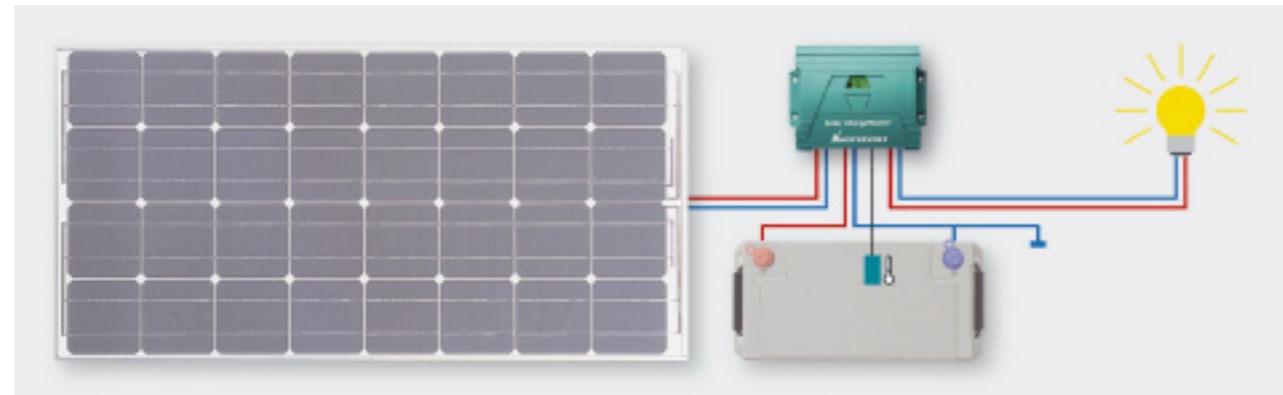
Mastervolt is pleased to announce its latest product release, the Solar ChargeMaster range, offering a 20 and a 40 A solar charge controller. This range has been developed using Mastervolt's 16 years of excellent expertise in the field of battery charging technologies.

The Solar ChargeMaster was designed specifically to meet the needs of rural solar electrification and small PV systems for telecom, remote cabins, weekend homes, and RV/ caravans and boats. The new product range is a welcome addition to Mastervolt's already extended portfolio, which includes a wide variety of maintenance free batteries, sine wave inverters and inverter/charger combinations, amp hour counters, battery chargers and DC-AC distribution components.

Adding an advanced solar controller is fitting entirely into the famous Mastervolt system approach which is now becoming reality in the autonomous solar field as well.

Mastervolt developed the Solar ChargeMaster series to guarantee an optimum charging process with cost efficiency. This highly advanced equipment converts unstable current from the solar panels into accurate charge current. The 3-step charging method guarantees that batteries will be charged safely and efficiently under all circumstances.

A battery temperature sensor is standard, designed to regulate the optimum charge voltage at each temperature, to prolong the lifespan of the battery.



Mastervolt Guarantee Plan • 5-year product warranty • worldwide service • 48-hour replacement service

Description of functions

- The charge controller protects the battery from being overcharged by the solar array and from being discharged too deeply by the load.
- The charge controller adjusts itself automatically to 12 V or 24 V system voltage.
- Pushbutton to switch the load on and off.
- The charge controller can be programmed for lighting applications.
- Many safety and display functions.
- Negative ground.
- Battery type presets.
- Equalization charge selectable.

Display mode

In normal operation mode the controller displays the state of charge (available energy) of the battery. Any change of the state of charge (SOC) to a lower status is additionally signaled acoustically. The display percentage corresponds to the available energy until Low Voltage Disconnect in relation to a fully charged battery.

As long as the solar array supplies enough voltage to charge the battery, this is indicated by up-moving bars alternately to the state of charge display.

Load management

In normal operation the loads can be switched on and off by pushing the button. This is indicated in the display.

Advance features

Low voltage disconnect function: The solar charge controller has multiple modes to protect the battery from being discharged and is factory programmed to the following load settings; disconnect at 11.4 V up to 11.9 V.

Nightlight timer function: The controller comes with a sophisticated nightlight function. It controls the load output at night. The controller recognizes day and night based on the solar open circuit voltage. In the programming menu this day and night threshold setting can be modified according to the requirements of the local conditions and solar array used (management for Streetlights).

Advanced programming function: The controller has an advanced programming mode for the setting of advanced features. Battery setting, low voltage disconnect setting, nightlight function and enable of acoustic alarm can be set to customers demands. The setting can be secured and locked by the programming lock-mode.

Solar ChargeMaster product specifications

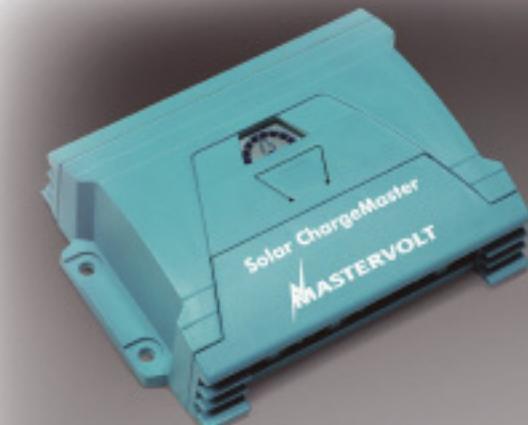


SCM-N 20



SCM-N 40

Article no.	131802000	131804000
Charge current	20 A	40 A
Max. DC load	20 A	40 A
System voltage	12/24 V auto detect	12/24 V auto detect
DC grounding	negative ground (the negative terminals are connected internally)	
No load	< 4 mA	< 4 mA
Functions LCD display	----- battery status/V/A/charge & discharge -----	
Connections	screw terminal	screw terminal
Settings	--- load/disconnect, 3-step charging algorithm ---	
Dimensions (hxwxd)	41 x 140 x 105	41 x 140 x 105
Protection degree enclosure	IP20	IP20
Weight	189 gr	189 gr



Overview sine wave inverters - AC Master range



**AC Master
12/200**



**AC Master
12/350**



**AC Master
24/200**



**AC Master
24/350**

	AC Master 12/200	AC Master 12/350	AC Master 24/200	AC Master 24/350
Article no. 230 V - continental European socket CEE-7/7	28010200	28010350	28020200	28020350
Article no. 230 V - IEC-1 socket	28010201	28010351	28020201	28020351
Article no. 120 V/60 Hz - US socket NEMA 5-15	n.a.	28510350	n.a.	n.a.
GENERAL SPECIFICATIONS				
Nominal battery voltage	12 V	12 V	24 V	24 V
Nom. power Tamb= 40 °C, cos phi 1	200 VA	350 VA	200 VA	350 VA
Peak load	400 VA	700 VA	400 VA	700 VA
Output waveform	true sine	true sine	true sine	true sine
Max. efficiency	90%	90%	93%	89%
Output voltage	230 V, ±5%	230 V, ±5%*	230 V, ±5%	230 V, ±5%
Frequency	----- 50 Hz, ±0.005% (60 Hz selectable)* -----			
Dimensions (hxwxd)	74 x 152 x 242 mm	74 x 152 x 242 mm	74 x 152 x 242 mm	74 x 152 x 242 mm
Weight	1.65 kg	1.85 kg	1.65 kg	1.85 kg
Protection degree	IP21	IP21	IP21	IP21
Min. battery capacity	>50 Ah	>80 Ah	>25 Ah	>40 Ah
TECHNICAL SPECIFICATIONS				
Switch off voltage low battery	10.5 V, ±0.5 V	10.5 V, ±0.5 V	21 V, ±0.5 V	21 V, ±0.5 V
Switch on voltage low battery	11 V, ±0.5 V	11 V, ±0.5 V	22 V, ±0.5 V	22 V, ±0.5 V
Switch off voltage high battery	16 V, ±1 V	16 V, ±1 V	32 V, ±1 V	32 V, ±1 V
Switch on voltage high battery	15.5 V, ±1 V	15.5 V, ±1 V	31 V, ±1 V	31 V, ±1 V
Max. allowable ripple on DC	5% RMS	5% RMS	5% RMS	5% RMS
Input current (nom. load)	23 A	38 A	15 A	25 A
No load power consumption :				
• Off mode	0 mA	0 mA	0 mA	0 mA
• 'high power' mode (230 V)	0.8 A / 9.6 W	0.8 A / 9.6 W	0.5 A / 12 W	0.5 A / 12 W
DC fuse required (slow blow)	30 A	40 A	20 A	30 A
Min. DC cable size	supplied	supplied	supplied	supplied
Harmonic distortion typical	3%	3%	3%	3%
Cooling	----- conventional / forced -----			
Cos Phi	----- all power factors allowed -----			
Operating temperature specified (will meet specified tolerances)	----- full spec 0 °C to 40 °C ambient temperature, 40 °C to 60 °C derating with 5% /°C. Shutdown @ 80 °C heat sink temperature. -----			
Practical operating temperature (may not meet specified tolerances)	----- -25 °C to 40 °C ambient temperature, 40 °C to 60 °C derating with 5% /°C. Shutdown @ 80 °C heat sink temperature. -----			
Relative humidity	----- Max. 95%, non condensing; protected against humidity and condensing air by conformal coating on both sides of all PCB's. -----			
Standard and Approvals	----- CE, E-marking -----			

* 120 V model: 120 Volt, ±5% / 60 Hz, ±0.005%.



SINE WAVE POWER



Overview sine wave inverters - Mass Sine range



	Mass Sine 12/500*	Mass Sine 12/800	Mass Sine 12/1200	Mass Sine 12/2000	Mass Sine 24/800	Mass Sine 24/1500	Mass Sine 24/2500	Mass Sine 24/5000	Mass Sine 24/10kVA	Mass Sine 24/15kVA	Mass Sine 48/2500						
Article no. 230 V	26010510	24010800	24011200	24012000	24020800	24021500	24022500	24095100	24026000	24027000	24042500						
Article no. 120 V**	27010510	n.a.	25011000	25012000	n.a.	25021000	25022500	25024000	n.a.	n.a.	n.a.						
GENERAL SPECIFICATIONS																	
Nominal battery voltage	12 V	12 V	12 V	12 V	24 V	24 V	24 V	24 V	24 V	24 V	48 V						
P30 power Tamb = 25 °C, cos phi 1	500 VA	800 VA	1200 VA	2000 VA	800 VA	1500 VA	2500 VA	5000 VA	10 kVA	15 kVA	2500 VA						
Nom. power Tamb = 40 °C, cos phi 1	450 VA	650 VA	1000 VA	1800 VA	650 VA	1200 VA	2000 VA	4000 VA	8 kVA	13 kVA	2000 VA						
Peak load	1000 VA	1600 VA	2400 VA	4000 VA	1600 VA	2900 VA	5000 VA	10000 VA	20 kVA	30 kVA	5000 VA						
Output waveform	true sine	true sine	true sine	true sine	true sine	true sine	true sine	true sine	true sine	true sine	true sine						
Max. efficiency	91%	92%	92%	92%	92%	92%	92%	90%	92%	92%	92%						
Output voltage	230 V, ±5%	230 V, ±5%	230 V, ±5%	230 V, ±5%	230 V, ±5%	230 V, ±5%	230 V, ±5%	230 V, ±5%	230 V, ±5%	230 V, ±5%	230 V, ±5%						
Frequency	----- 50Hz, ±0.005% (also available in 60Hz) -----				----- 50Hz, ±0.005% (also available in 60Hz) -----												
Dimensions in mm (hxwxd)	313 x 187 x 82	325 x 220 x 111	340 x 261 x 130	420 x 318 x 130	325 x 220 x 111	340 x 261 x 130	420 x 318 x 130	475.5 x 318 x 254	2x C4 + C5***	3x C4 + C5***	420 x 318 x 130						
Weight	3.4 kg	3.9 kg	6 kg	9.4 kg	3.9 kg	6 kg	9.7 kg	19 kg	44 kg	55 kg	9.7 kg						
Minimum battery capacity	>100 Ah	>100 Ah	>150 Ah	>200 Ah	>50 Ah	>150 Ah	>200 Ah	>400 Ah	>500 Ah	>800 Ah	>100 Ah						
TECHNICAL SPECIFICATIONS																	
Switch off voltage low battery	10 V, ±0.5 V	10 V, ±0.5 V	10 V, ±0.5 V	10 V, ±0.5 V	19 V, ±0.5 V	19 V, ±0.5 V	19 V, ±0.5 V	19 V, ±0.5 V	19 V, ±0.5 V	19 V, ±0.5 V	36 V, ±0.5 V						
Switch on voltage low battery	11 V, ±0.5 V	11 V, ±0.5 V	11 V, ±0.5 V	11 V, ±0.5 V	22 V, ±0.5 V	22 V, ±0.5 V	22 V, ±0.5 V	22 V, ±0.5 V	22 V, ±0.5 V	22 V, ±0.5 V	44 V, ±0.5 V						
Switch off voltage high battery	15.5 V, ±0.5 V	15.5 V, ±0.5 V	15.5 V, ±0.5 V	15 V, ±0.5 V	31 V, ±0.5 V	33 V, ±0.5 V	33 V, ±0.5 V	32 V, ±0.5 V	33 V, ±0.5 V	33 V, ±0.5 V	62 V, ±0.5 V						
Switch on voltage high battery	14.5 V, ±0.5 V	14.5 V, ±0.5 V	14.5 V, ±0.5 V	14.5 V, ±0.5 V	30 V, ±0.5 V	31 V, ±0.5 V	31 V, ±0.5 V	31 V, ±0.5 V	31 V, ±0.5 V	31 V, ±0.5 V	59 V, ±0.5 V						
Max. allowable ripple on DC	5% RMS	5% RMS	5% RMS	5% RMS	5% RMS	5% RMS	5% RMS	5% RMS	5% RMS	5% RMS	5% RMS						
Input current (nominal load)	23 A	38 A	42 A	68 A	34 A	70 A	120 A	240 A	4x 120 A	6x 120 A	60 A						
No load power consumption:																	
• stand-by mode	43 mA/0.5 W	65 mA/0.8 W	43 mA/0.5 W	50 mA/0.6 W	35 mA/0.8 W	25 mA/0.6 W	25 mA/0.6 W	n.a.	<10 W, 412 mA	<10 W, 412 mA	13 mA/0.7 W						
• 'low energy' mode (208 V)	300 mA/3.6 W	410 mA/4.9 W	420 mA/4.5 W	420 mA/5 W	200 mA/4.9 W	180 mA/4.5 W	225 mA/5.4 W	n.a.	n.a.	n.a.	110 mA/5.4 W						
• 'high power' mode (230 V)	325 mA/3.9 W	470 mA/5.6 W	450 mA/5 W	480 mA/6 W	240 mA/5.6 W	200 A/5 W	250 A/6 W	250 mA/6 W	150 W	180 W	125 mA/6 W						
DC fuse required (slow blow)	100 A	100 A	120 A	240 A	63 A	100 A	160 A	2x 160 A	4x 160 A	6x 160 A	100 A						
Minimum DC cable size	16 mm ²	25 mm ²	50 mm ²	70 mm ²	16 mm ²	25 mm ²	50 mm ²	2x 50 mm ²	4x 50 mm ²	6x 50 mm ²	50 mm ²						
Harmonic distortion typical	3%	3%	3%	3%	3%	3%	3%	3%	2.5%	2.5%	3%						
AC connection (single phase, 3-wire)	IEC-1	internal	internal	internal	internal	internal	internal	internal	internal	internal	internal						
Cos Phi	----- all power factors allowed -----				----- all power factors allowed -----												
OPTIONS																	
Model C4-R1 (art. no. 70404110)		----- remote control on/off for Mass Sine inverter -----				----- remote control on/off for Mass Sine inverter -----											
Masterlink/MICC		----- battery consumption meter, 12/24 V DC with LCD readout, remote control for Mass Sine inverter and battery charger or Mass Combi -----				----- n.a. -----											
System Manager MICC (art. no. 70400115)		----- battery consumption meter, 12/24 V DC with LCD readout and LED bar, comprehensive remote control for Mass Sine inverter and Mass charger -----				----- n.a. -----											
MasterBus Inverter Interface (art. no. 77030700)	----- suitable for all Mass Sine inverters, available from April 2008 onwards -----				----- suitable for all Mass Sine inverters, available from April 2008 onwards -----												
Universal connection cables for the remote controls:	• 6 metre - art. no. 6502001030 • 10 metre - art. no. 6502100100 • 15 metre - art. no. 6502100150																
Transfer system	----- the Masterswitch and Systemswitch can be connected to all inverters -----				----- the Masterswitch and Systemswitch can be connected to all inverters -----												

* Also available for 48 V, art. no. 48/500: 24040500.

** 15% load reduction for the 120 V/60 Hz models.

*** C4 enclosure = 460.6 x 318 x 143 mm, C5 enclosure = 475.5 x 318 x 254 mm (hxwxd).



Overview sine wave inverter/charger combinations: Mass Combi series



**Mass Combi
12/1200-60**

**Mass Combi
12/2000-100**

**Mass Combi
12/2500-125**

**Mass Combi
12/4000-200**

**Mass Combi
24/1200-35**

**Mass Combi
24/2000-60**

**Mass Combi
24/2500-75**

**Mass Combi
24/4000-100**

Article no. 230 V/50 Hz	36011205	36012005	available April 2008	36014005	36021205	36022005	available April 2008	36024005
Article no. 120 V/60 Hz	n.a.	37012005		37014005	n.a.	37022005		37024005
SINE WAVE INVERTER - SPECIFICATIONS								
DC input voltage (nominal)	12 V (10 to 15 V)	12 V (10 to 15 V)	12 V (10 to 15 V)	12 V (10 to 15 V)	24 V (20 to 31 V)	24 V (20 to 31 V)	24 V (20 to 31 V)	24 V (20 to 31 V)
Continuous power @ 25 °C	1200 VA - 5.3 A	2000 VA - 8.7 A	2500 VA - 10.9 A	3750 VA - 16.5 A	1200 VA - 5.3 A	2000 VA - 8.7 A	2500 VA - 10.9 A	3750 VA - 16.5 A
Surge capability (5 sec., resistive)	2400 VA - 10.5 A	4000 VA - 17.5 A	5000 VA - 21.8 A	7500 VA - 32 A	2400 VA - 10.5 A	4000 VA - 17.5 A	5000 VA - 21.8 A	7500 VA - 32 A
Parallel use (to double the power)	no	yes	yes	no	no	yes	yes	no
Parallel with shore/generator (for more power)	yes	yes	yes	yes	yes	yes	yes	yes
Output voltage, adjustable via MasterAdjust software	230 V, ±5%	230 V, ±5%	230 V, ±5%	230 V, ±5%	230 V, ±5%	230 V, ±5%	230 V, ±5%	230 V, ±5%
Frequency	----- 50 Hz, ±0.003% (60 Hz selectable) -----			----- 50 Hz, ±0.003% (60 Hz selectable) -----				
Output waveform	true sine wave	true sine wave	true sine wave	true sine wave	true sine wave	true sine wave	true sine wave	true sine wav
Max. efficiency	92%	92%	92%	92%	92%	92%	92%	92%
No load consumption 230 V	<9 W	<9 W	<9 W	<9 W	<9 W	<9 W	<9 W	<9 W
Search mode consumption + setting range	0.5 W - 40/150 VA	0.5 W - 40/150 VA	0.5 W - 40/150 VA	1 W - 40/150 VA	0.5 W - 40/150 VA	0.5 W - 40/150 VA	0.5 W - 40/150 VA	1 W - 40/150 VA
Dimensions in mm (hxwxd)	371 x 318 x 143	460.5 x 318 x 143	460.5 x 318 x 143	460.5 x 318 x 266	371 x 318 x 143	460.5 x 318 x 143	460.5 x 318 x 143	460.5 x 318 x 266
Weight	7.8 kg	11 kg	11 kg	21 kg	7.8 kg	11 kg	11 kg	21 kg
AUTOMATIC BATTERY CHARGER - SPECIFICATIONS								
Input voltage nominal	230 V (180 to 265 V)	230 V (180 to 265 V)	230 V (180 to 265 V)	230 V (180 to 265 V)	230 V (180 to 265 V)	230 V (180 to 265 V)	230 V (180 to 265 V)	230 V (180 to 265 V)
Frequency	45 to 65 Hz	45 to 65 Hz	45 to 65 Hz	45 to 65 Hz	45 to 65 Hz	45 to 65 Hz	45 to 65 Hz	45 to 65 Hz
Max. charge rate (adjustable)	60 A @ 14.25 V	100 A @ 14.25 V	125 A @ 14.25 V	200 A @ 14.25 V	35 A @ 28.5 V	60 A @ 28.5 V	75 A @ 28.5 V	120 A @ 28.5 V
Primary AC consumption (full charge)	1000 VA - 4.4 A	1635 VA - 7.2 A	2045 VA - 8.9 A	3270 VA - 14.4 A	1170 VA - 5.1 A	1965 VA - 8.5 A	2455 VA - 10.7 A	3900 VA - 17 A
Charge voltage @ 25 °C (bulk/float)	14.25/13.25 V	14.25/13.25 V	14.25/13.25 V	28.5/26.5 V	28.5/26.5 V	28.5/26.5 V	28.5/26.5 V	28.5/26.5 V
Battery type settings	----- open lead / gel / traction / AGM / spiral -----			----- open lead / gel / traction / AGM / spiral -----				
Second charge output, 3-step [⊕]	5 A	5 A	5 A	2x 5 A	5 A	5 A		2x 5 A
Temperature sensor for the battery	----- delivered as standard with 6 metre cable and telejack plug -----			----- delivered as standard with 6 metre cable and telejack plug -----				
DOUBLE POLE TRANSFER SYSTEM								
Max. current first output	50 A	50 A	50 A	50 A	50 A	50 A	50 A	50 A
Max. current shortbreak / inverter output	25 A	25 A (35 A @ 120 V)	50 A	25 A (35 A @ 120 V)	25 A	25 A	50 A	25 A (35 A @ 120 V)
Transfer time	10 ms	10 ms	10 ms	10 ms	10 ms	10 ms	10 ms	10 ms
GENERAL SPECIFICATIONS								
Harmonic distortion (typical)	<5%	<5%	<5%	<5%	<5%	<5%	<5%	<5%
Temperature range	----- according specifications: 0 to 25 °C, thereafter derating -----			----- according specifications: 0 to 25 °C, thereafter derating -----				
Grounding	----- yes, adjustable by DIP switch -----			----- yes, adjustable by DIP switch -----				
Forced air cooling	----- maintenance free vario fans -----			----- maintenance free vario fans -----				
Listings	---- fully CE and E-marking according Automotive Directive 95/54/EG ----			---- fully CE and E-marking according Automotive Directive 95/54/EG -----				
REMOTE CONTROL AND MONITORING								
Remote ICC (art. no. 70405000)		optional	delivered as standard	option: MasterView Indication of DC consumption, charge phase, failure and AC availability. With on/off/ 'charger only' switch. Standard equipped with 6 metre cable.	delivered as standard	optional	delivered as standard	option: MasterView delivered as standard
Remote APC (art. no. 70405010)		optional	optional	option: MasterView Indication of AC consumption, AC voltage and the fuse value of the shore/generator	optional	optional	optional	option: MasterView optional
Masterlink/MICC (art. no. 70403105)		optional	optional	option: MasterView Battery consumption meter, 12/24 V DC with LCD readout and remote control for	optional	optional	optional	option: MasterView optional

Mastervolt Guarantee Plan

• 2-year product warranty • worldwide service • Mastervolt 3-step[⊕] charging method • pure sine wave power • galvanic isolation



Overview battery chargers - IVO & Mass range



	IVO Smart 12/10 - IP65	IVO Compact 12/25-3	Mass 12/60-2	Mass 12/80-2	IVO Smart 24/6 - IP65	Mass 24/50-2	Mass 24/100-C	Mass 24/100-3ph	Mass 48/25	Mass 48/50
Article no.	43011000	43012500	40010600	40010800	43020600	40020500	40021005	40031000	40040250	40040500
GENERAL SPECIFICATIONS										
Nominal input voltage	230 V (180 to 250 V)	120/230 V (auto*)	-----	230 V (180 to 250 V) -----	-----	230 V (180 to 250 V) -----	-----	3x400 V (360 to 485 V)	-----	230 V (180 to 250 V) -----
Nominal output voltage	12 V	12 V	12 V	12 V	24 V	24 V	24 V	24 V	48 V	48 V
Total charge current	10 A	25 A	60 A	80 A	6 A	50 A	100 A	100 A	25 A	50 A
Number of battery outlets	1	3	2	2	1	2	1	1	1	1
Charge current second (third output)	n.a.	25 A (3 A)	3 A	3 A	n.a.	3 A	optional, 3 A	optional, 3 A	n.a.	n.a.
Charge characteristic	-----	IUoUo, automatic / 3-step [⊕]	-----	-----	-----	IUoUo, automatic / 3-step [⊕]	-----	-----	-----	-----
Charge voltage Bulk @ 25 °C	14.40 V	14.40 V	14.25 V	14.25 V	28.80 V	28.50 V	28.50 V	28.50 V	57.0 V	57.0 V
Charge voltage Absorption @ 25 °C	14.25 V	14.25 V	14.25 V	14.25 V	28.50 V	28.50 V	28.50 V	28.50 V	57.0 V	57.0 V
Charge voltage Float - wet @ 25 °C	13.25 V	13.25 V	13.25 V	13.25 V	26.50 V	26.50 V	26.50 V	26.50 V	53.0 V	53.0 V
Charge voltage Float - gel/AGM @ 25 °C	13.80 V	13.80 V	13.80 V	13.80 V	27.60 V	27.60 V	27.60 V	27.60 V	55.2 V	55.2 V
Max. absorption time	6 hours	6 hours	6 hours	6 hours	6 hours	6 hours	6 hours	6 hours	6 hours	6 hours
Min. absorption time	15 min.	15 min.	15 min.	15 min.	15 min.	5 min.	15 min.	15 min.	15 min.	15 min.
Dimensions in mm (hxwxd)	180 x 121 x 50	228 x 153 x 82	340 x 261 x 130	340 x 261 x 130	180 x 121 x 50	340 x 261 x 130	420 x 318 x 130	420 x 318 x 130	340 x 261 x 130	420 x 318 x 130
Weight	1 kg	1.8 kg	4.6 kg	4.6 kg	1 kg	4.6 kg	7.7 kg	7.7 kg	4.6 kg	7.7 kg
Battery capacity (recommendation)	25 to 150 Ah	50 to 300 Ah	120 to 600 Ah	160 to 800 Ah	25 to 100 Ah	100 to 500 Ah	200 to 1000 Ah	200 to 1000 Ah	50 to 250 Ah	100 to 500 Ah
TECHNICAL SPECIFICATIONS										
Power factor regulation	>0.95	0.99	>0.95	>0.95	>0.95	>0.95	>0.95	>0.95	>0.95	>0.95
Full load consumption (230 V AC)	170 W	440 W	1100 W	1400 W	210 W	1800W	3500 W	3500 W	1800 W	3500 W
Temperature compensation (by means of a sensor)	n.a.	-30 mV/°C	-30 mV/°C	-30 mV/°C	n.a.	-60 mV/°C	-60 mV/°C	-60 mV/°C	-120 mV/°C	-120 mV/°C
Temperature range	-----	0 °C to 60 °C, fully safeguarded against overheating and short circuiting	-----	-----	-----	0 °C to 60 °C, fully safeguarded against overheating and short circuiting	-----	-----	-----	-----
Cooling	natural cooling	vario fan	vario fan	vario fan	natural cooling	vario fan	vario fan	vario fan	vario fan	vario fan
Protection degree	IP65	IP21	IP23	IP23	IP65	IP23	IP23	IP23	IP23	IP23
Approvals	generic emission and interference standard: EN 55014-1:1993, generic harmonic current emissions: EN61000-3-3:1995, generic & safety accreditations immunity standard: EN 55014-2:1997, electrostatic discharge: EN 61000-4-2:1995, electrical fast transients: EN 61000-4-4:1995, surge transient: EN61000-4-5:1995, conducted radio frequency interference: EN61000-4-6:1996, voltage dips: EN 61000-4-11:1994									
OPTIONS										
Remote CC (art. no. 70405030)		n.a.	yes**	yes	n.a.	yes	yes	yes	yes	yes
		Indication of charge phase, charge current and battery charger operation.								
Model C4-RB (art. no. 70404100)		n.a.	n.a.	yes	yes	n.a.	yes	yes	yes	yes
		Monitoring panel for Mass and IVO battery charger.								
Model C3-RS (art. no. 70403040)		n.a.	yes	yes	yes	n.a.	yes	yes	yes	yes
		Remote monitor for battery chargers, with control for reducing shore power consumption.								
Masterlink/MICC (art. no. 70403105)		n.a.	yes	yes	yes	n.a.	yes	yes	n.a.	n.a.
		Battery consumption meter, 12/24 V DC with LCD readout and remote control for Mass Sine inverter and battery charger or Mass Combi.								
System Manager MICC (art. no. 70400115)		n.a.	n.a.	yes	yes	n.a.	yes	yes	n.a.	n.a.
		Battery consumption meter, 12/24 V DC with LCD readout and LED bar. Comprehensive remote control for Mass Sine inverter and Mass charger.								
MasterAdjust communication connection***	QRS232	QRS232	QRS232	QRS232	QRS232	QRS232	QRS232+RS485	QRS232	QRS232+RS485	QRS232+RS485
Universal connection cables for the remote controls:	• 6 metre - art. no. 6502001030	• 10 metre - art. no. 6502100100	• 15 metre - art. no. 6502100150							

* Autoranging: operates on 120 V and 230 V, charge current reduction at 120 V: 20 to 30%.

** T-connection necessary to connect both temperature sensor and remote CC, art. no. 21730200.

*** Galvanic isolation RS485 communication port.



3STEP[⊕]



Mastervolt Guarantee Plan

• 2 year product warranty • worldwide service • Mastervolt 3-step[⊕] charging method • galvanic isolation

Overview Mastervolt maintenance-free batteries

- 12 V AGM batteries: sealed batteries with glass fibre technique. For cyclic application.
- 12 V gel batteries: sealed batteries with electrolyte in a gel substance. For intensive cyclic application.
- 2 V gel batteries: extremely durable, absolutely maintenance-free batteries. For larger systems with intensive deep cycle application.

These batteries are extremely suitable for use in solar and back up power applications.
Mastervolt batteries can be shipped by air freight, 'non-hazardous' declaration available on request.

		AGM 12/55 12 V		AGM 12/70 12 V		AGM 12/90 12 V		AGM 12/130 12 V		AGM 12/160 12 V		AGM 12/225 12 V		AGM 12/270 12 V		MVG 12/25 12 V gel		MVG 12/55 12 V gel		MVG 12/85 12 V gel		MVG 12/120 12 V gel		MVG 12/140 12 V gel		MVG 12/200 12 V gel
Article no.	62000550	62000700	62000900	62001300	62001600	62002250	62002700	64000250	64000550	64000850	64001200	64001400	64002000													
Nominal voltage	12 V	12 V	12 V	12 V	12 V	12 V	12 V	12 V	12 V	12 V	12 V	12 V	12 V													
Capacity C20*	55 Ah	70 Ah	90 Ah	130 Ah	160 Ah	225 Ah	270 Ah	25 Ah	55 Ah	85 Ah	120 Ah	140 Ah	200 Ah													
Dimensions, lwxh in mm (excl. poles)	257 x 132 x 200	348 x 167 x 178	330 x 173 x 212	410 x 177 x 225	485 x 170 x 242	522 x 240 x 218	522 x 268 x 220	164 x 173 x 126	253 x 133 x 208	330 x 171 x 214	475 x 178 x 195	475 x 210 x 195	475 x 265 x 216													
Dimensions, lwxh in mm (incl. poles)	257 x 132 x 207	348 x 167 x 181	330 x 173 x 237	410 x 177 x 228	485 x 170 x 245	522 x 240 x 241	522 x 268 x 243	167 x 176 x 126	261 x 136 x 230	330 x 171 x 236	513 x 189 x 223	513 x 223 x 223	518 x 274 x 238													
Weight	17 kg	21.5 kg	28 kg	37 kg	42.3 kg	63.5 kg	73 kg	9.6 kg	19 kg	32.6 kg	41 kg	49 kg	70 kg													
Max. installation angle	180°	180°	180°	180°	180°	180°	180°	180°	180°	180°	180°	180°	180°													
Cold starter current DIN	492 A	617 A	885 A	1249 A	1518 A	1980 A	2239 A	110 A	230 A	270 A	450 A	540 A	630 A													
Cold starter current SAE	562 A	705 A	1012 A	1425 A	1722 A	2261 A	2557 A	175 A	380 A	450 A	760 A	920 A	1100 A													
Short circuit current (IEC 60896-2-1)	1500 A	1620 A	2700 A	2000 A	3500 A	3650 A	4400 A	583 A	1403 A	2018 A	2475 A	3132 A	3606 A													
Guarantee period	2 year	2 year	2 year	2 year	2 year	2 year	2 year	2 year	2 year	2 year	2 year	2 year	2 year													

* C20 standard = battery capacity at a discharge time of 20 hours at 5% discharge rate.
Compare batteries on the basis of their weight! See next pages for comprehensive battery information.



	MVSV 280 2 V gel cell	MVSV 420 2 V gel cell	MVSV 500 2 V gel cell	MVSV 580 2 V gel cell	MVSV 750 2 V gel cell	MVSV 1000 2 V gel cell	MVSV 1250 2 V gel cell	MVSV 1500 2 V gel cell	MVSV 1650 2 V gel cell	MVSV 2200 2 V gel cell	MVSV 2700 2 V gel cell	
Article no.	68000280	68000420	68000500	68000580	68000750	68001000	68001250	68001500	68001650	68002200	68002700	
Nominal voltage	2 V	2 V	2 V	2 V	2 V	2 V	2 V	2 V	2 V	2 V	2 V	
Capacity C10*	280 Ah	420 Ah	500 Ah	580 Ah	750 Ah	1000 Ah	1250 Ah	1500 Ah	1650 Ah	2200 Ah	2700 Ah	
Dimensions, lwxh in mm (excl. poles)	125 x 207 x 357	125 x 207 x 473	146 x 207 x 473	167 x 207 x 473	146 x 207 x 648	211 x 192 x 647	211 x 234 x 648	211 x 276 x 648	211 x 276 x 798	214 x 399 x 775	214 x 488 x 774	
Dimensions, lwxh in mm (incl. poles)	125 x 207 x 401	125 x 207 x 517	146 x 207 x 517	167 x 207 x 517	146 x 207 x 693	212 x 192 x 693	211 x 234 x 693	211 x 276 x 693	211 x 276 x 843	214 x 399 x 819	214 x 488 x 819	
Installation length	134 mm	134 mm	155 mm	176 mm	155 mm	210 mm	220 mm	220 mm	220 mm	223 mm	222 mm	
Number of pole pairs	1	1	1	1	1	2	2	2	2	3	4	
Weight	22 kg	32 kg	37 kg	42 kg	50 kg	68 kg	82 kg	98 kg	112 kg	153 kg	196 kg	
Guarantee period	----- 7 year pro rata, ask for comprehensive terms -----						----- 7 year pro rata, ask for comprehensive terms -----					

A 12 V battery set consists of six 2 V elements while a 24 V configuration consists of twelve elements.
The sets are supplied complete with connection cables to connect the poles.
All models are suitable for both horizontal and vertical mounting, rack or stack configuration allowed.

* C10 stands for capacity at a discharge time of 10 hours at 10% discharge rate.
See next pages for comprehensive battery information.



Mastervolt Guarantee Plan

• 2-year product warranty • 7-year product warranty (2 V cells) • worldwide service



Your battery as a power source



Mastervolt gel batteries.

There are different kinds of rechargeable batteries. The most common and widespread type is the lead-acid battery. A less familiar one is the nickel-cadmium (NiCad) battery, which can still often be found in old emergency power systems. Due to the complex charge method required by a NiCad battery, and the fact that they are environmentally unsound, these batteries are not suitable for use onboard a boat.

The principle of the lead-acid battery

A battery is a device that stores electric power in the form of chemical energy. When necessary, the energy is again released as electric power for DC consumers such as lighting and starter motors. A battery consists of several galvanic cells with a voltage of 2 Volt each. For a 12 Volt battery, six cells are linked in series and fitted inside a single casing. To achieve 24 Volt, two 12 Volt batteries are linked in series. Each cell has positive oxidised lead plates and negative lead metal plates, and has an electrolyte consisting of water and sulphuric acid. During discharging, the lead oxide on the lead plates is converted into lead. The acid content decreases because sulphuric acid is required for this process.

To recharge the battery, an external power source - such as a battery charger, alternator or solar panel - with a voltage of around 2.4 Volt per cell must be connected. The lead sulphate will then be converted back into lead and lead oxide, and the sulphuric acid content will rise. There are limits set for the charge voltage to prevent the release of an excessive amount of hydrogen. A charge voltage of more than 2.4 Volt per cell, for instance, releases a lot of hydrogen gas, which can form a highly explosive mixture with the oxygen in the air. The upper limit on charge voltage for a 12 Volt battery is 14.4 Volt, and the corresponding value for a 24 Volt battery is 28.8 Volt. The relationship between how full a battery is and the specific gravity of the water/sulphuric acid mixture is as follows:

percentage charged	battery voltage	specific gravity	percentage discharged
0%	11.64 Volt	1.100	100%
20%	11.88 Volt	1.140	80%
40%	12.09 Volt	1.175	60%
60%	12.30 Volt	1.210	40%
80%	12.51 Volt	1.245	20%
100%	12.72 Volt	1.280	0%

Different types of battery - in terms of the thickness and number of plates per cell - correspond to different applications. The maximum current that can be delivered is determined by the total plate surface. The number of times that a battery can be discharged and recharged - the number of cycles - depends on the thickness of the plates. A battery can feature either many thin plates or a few thick ones.

The starter battery

A starter battery has many thin plates per cell, leading to a large total plate surface. This type of battery is, therefore, suitable for delivering a high level of current over a short period of time. The number of times that a starter battery can be heavily discharged is limited to around 50. But as starting the engine uses only a small part of the energy stored (around 0.01%), the battery lasts for many years. This type of battery is unsuitable for cyclical use as a service battery. Mastervolt's AGM and gel batteries are suitable to be used as starter batteries.

The semi-traction battery

A semi-traction battery has fewer but thicker plates in each cell. These batteries supply relatively less starter current, but can be discharged more often and to a greater extent (approximately 300 full cycles). This kind of battery is highly appropriate for the combined function of starter/service battery. Mastervolt recommends to use maintenance free 'deep cycle' AGM or gel batteries (see previous pages). It is important to charge the batteries according to the appropriate charge characteristic.

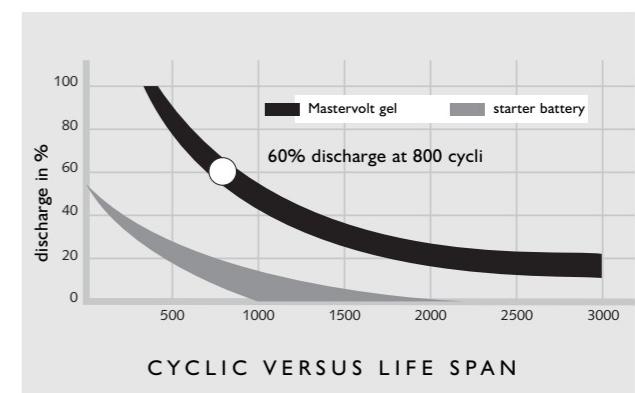


'Sealed' traction battery.

The traction battery

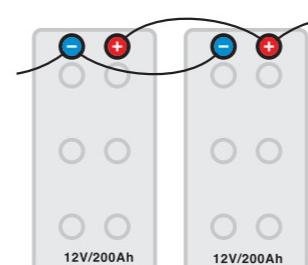
This type of battery has even fewer, but very thick, flat or cylindrical plates. It can therefore be discharged many times and fairly completely (1000 full cycles). This is why wet traction batteries are often used in forklifts and industrial-grade cleaning machines. But wet traction batteries require a special charge method. Because these batteries are mostly tall, they are sensitive to the accumulation of sulphuric acid at the bottom of the battery container. This phenomenon is called stratification and occurs because sulphuric acid is denser than water.

Acid content increases in the lower part of the battery, locally intensifying plate corrosion, and decreases in the upper part, reducing capacity. The battery is discharged unevenly, significantly reducing the life span. In order to spread out the acid evenly again, the battery has to be purposefully overloaded using excessive voltage. This generates a large amount of hydrogen gas, which will form a dangerous mixture with oxygen in the air. The voltage required to recharge these batteries is around 2.7V per cell, or 16.2V for a 12V system and 32.4V for a 24V system. These high levels of voltage are extremely dangerous for the connected equipment and the large amount of gas generated makes these batteries unsuitable for use on board boats. Mastervolt recommends to install maintenance free 2 volt gel cells. An appropriate charge protocol should be followed.



Parallel connection

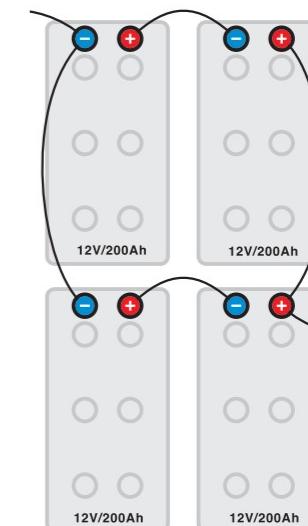
Parallel coupling involves connecting the plus poles of multiple batteries to each other and the same with the minus poles. The plus of the first battery and the minus of the last battery are then connected to the system. This type of arrangement is used to increase capacity (in this case 400 Ah).



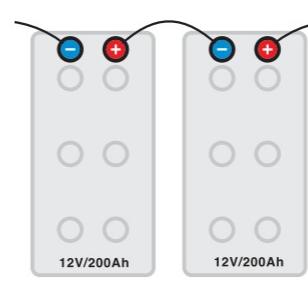
12 V/400 Ah parallel coupling.

Series/parallel connection

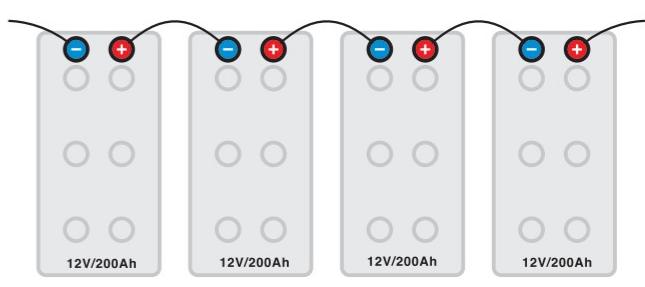
A combination of series and parallel connections is required if you need for example a 24 Volt battery set with a higher capacity. The battery should then be cross-wired to the system using the plus pole of the first and minus pole of the last battery.



24 V/400 Ah series/parallel connection.



24 V/200 Ah series connection.



48 V/200 Ah series connection.



Overview of battery monitoring panels & inverter/charger remote panels

A Mastervolt battery monitoring system brings an end to unpleasant surprises. A clear display shows performance, consumption and available battery capacity. Below we have listed the available monitoring panels for Mass Sine, Mass Combi and Dakar Combi models.



Masterlink MICC



Masterlink BTM-III



Masterlink DCV



**APC remote control
for Mass Combi**



**Modell ICC for
Mass Combi (standard)**



C-4-RI



MasterView Easy

Article no.	70403105	70403163	70403180	70405010	70405000	70404110	77010300
Application	Battery consumption meter, 12/24 V DC with LCD readout. Remote control for Mass Sine inverter and battery charger or Mass Combi.	Battery consumption meter, 12/24 V DC with LCD readout and LED bar. Also available for 48 V DC.	Battery condition meter for three independent batteries, 12/24 V DC.	Indication of AC consumption, AC voltage and the fuse value of the shore/generator connection. With Power Sharing setting.	Indication of DC consumption, charge phase, failure and AC availability. With on/off/ 'charger only' switch.	Remote control on/off for Mass sine wave inverter.	The MasterView Easy panel, in combination with a MasterShunt (art. no. 77020100), is the world's most advanced battery monitor.
TECHNICAL SPECIFICATIONS							
Number of battery sets	2 battery banks	3 battery banks	3 battery banks	n.a.	1 battery bank	n.a.	one battery set per MasterShunt
Readout voltage	yes	yes	yes	yes (AC)	yes	n.a.	yes
Readout current	yes	yes	no	yes (AC power)	yes	n.a.	yes
Readout Amp-hours	yes	yes	no	no	no	n.a.	yes
Time remaining indication	yes	yes	no	no	no	n.a.	yes
Battery capacity in %	yes	yes	yes	no	no	n.a.	yes
Inverter operation	yes	no	no	no	yes	yes	yes
Battery charger operation	yes	no	no	no	yes	no	yes
'Power Sharing' adjustment	yes	no	no	yes	no	no	yes
Compatible with MasterVision	yes	yes	yes	optional	optional	optional	no
Current consumption (backlight off)	28 mA/12 V - 26 mA/24 V	14 mA/12 V - 11 mA/24 V	15 mA	n.a.	n.a.	n.a.	32 mA/12 V - 17 mA/24 V
Current consumption (backlight on)	100 mA/12 V - 50 mA/24 V	100 mA/12 V - 50 mA/24 V	100 mA/12 V - 50 mA/24 V	n.a.	n.a.	n.a.	100 mA/12 V - 50 mA/24 V
Supply voltage	9 to 35 V DC	9 to 35 V DC	9 to 32 V DC	n.a.	n.a.	n.a.	9 to 60 V DC
Voltage range measurement	7 to 35 V DC	7 to 35 V DC	7 to 32 V DC	180 to 260 V AC	7 to 35 V DC	n.a.	0 to 60 V DC
Voltage resolution	0.05 V	0.01 V	0.1 V	n.a.	n.a.	n.a.	0.01 V
Voltage deviation	±0.6% ±1 figure	±0.6% ±1 figure	±0.6% ±1 figure	n.a.	n.a.	n.a.	±0.6% ±1 figure
Amps measurement range	0 to 500 A	0 to 500 A	n.a.	n.a.	n.a.	n.a.	0 to 500 A
Max. Amp-hour capacity	9999 Ah	9999 Ah	9999 Ah	n.a.	n.a.	n.a.	9999 Ah
Shunt specification	500 A / 50 mV (service set)	500 A / 50 mV (service set)	n.a.	n.a.	n.a.	n.a.	digital shunt
Dimensions instrument (w x h)	120 x 65 mm	120 x 65 mm	120 x 65 mm	120 x 24 mm	120 x 24 mm	60 x 65 mm	113 x 113 mm
Built-in depth incl. / excl. cover box	55 mm / 40 mm	55 mm / 40 mm	55 mm / 40 mm	18.5 mm	18.5 mm	28 mm	surface mount
Weight instrument incl. shunt	0.9 kg	0.9 kg	0.25 kg	140 gr	140 gr	60 gr	1.2 kg
Dimensions shunt (hxwxh)	84 x 44 x 44 mm - M8	84 x 44 x 44 mm - M8	n.a.	n.a.	n.a.	n.a.	228 x 150 x 64 mm
Battery alarm contact	yes, potential free	yes, open collector	yes, open collector	no	no	n.a.	yes, via MasterBus alarm interface
Connection cable (6-wire) necessary Art. no. 6801601200	yes, 2 pcs	no	no	yes	yes	yes	MasterBus cable included
Languages	english	english, dutch, german, french, italian, danish, norwegian, swedish & finnish	english	english	english	english	english, dutch, german, french, italian, danish, norwegian, swedish & finnish



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Mastervolt Guarantee Plan • 2-year product warranty • worldwide service

Communication using Mastervolt system components

Mastervolt equipment communicates with each other and the outside world in various ways. This optimises the user-friendliness of Mastervolt power systems and makes interfacing with other onboard functions possible. With this purpose in mind, the following protocols have been developed:

MasterBus

System intended for all communications between the Mastervolt system components. As it is a closed MasterBus system, it is not able to communicate with other systems.

MassNet

Open protocol for communication with the outside world, and the Mastervolt system components, which are in mutual communication with MasterBus. Using MassNet, Mastervolt system information and controls can be easily integrated.

MasterAdjust software

Order handy and up-to-date MasterAdjust software free from the Mastervolt website. This software can be used by the installer to accurately tune Mastervolt equipment to its relevant application and allows various parameters to be read and set according to need. Parameters such as voltage, current, switch-off points and charging algorithms are just a few of the many options for adjustment.

MasterBus-USB interface

The MasterBus-USB interface enables communication between PC/laptop and all MasterBus products. It is possible to adapt specific installations or functions to the demands of the power system.

MasterBus PC-Link

In order to make use of MasterAdjust software, you will usually need a MasterBus PC-Link to serve as an interface between your computer/laptop and Mastervolt equipment. This MasterBus PC-Link can be directly connected to a computer serial port.

Overview of the available software

Mastervolt aims to create the broadest package of software for as many products as possible. The software available will be continuously expanded in the coming years. Check our website regularly for the latest updates.

MasterAdjust software for system components

This software can be used to configure, monitor and log multiple products. The key aspects are:

- One software package; for 47 different products.
- Easy to use 'Windows Explorer' like user interface.
- Connect multiple products simultaneously.
- Log multiple products to a data file: 'system logger'.

Connect the Mastervolt products via:

- PC-Link, article no. 21730100.

This is an interface between one Mastervolt product and a PC or Laptop; or

- PC-Link with galvanic isolation, article no. 21730300.

This is an interface between one Mastervolt product and a PC or Laptop;

- MasterBus USB interface with galvanic isolation, article no. 77030100. This is an interface between a MasterBus network, which may consist of one or several Mastervolt products. All these products should be equipped with MasterBus compatibility.

System component	via PC-Link art. no. 21730100 or 21730300	via MasterBus- USB Interface art. no. 77030100
BTM-I + 48 V	X	
BTM-III	X	
MAC 24/12-20	X	
MAGIC 24/12-20	X	
MAGIC 24/24-20	X	
MAGIC 12/12-20	X	
MAGIC 12/24-10	X	
MasterShunt		X
DC Distribution		X
DC Switching		X
MasterView Classic		X
MasterView Easy		X
MasterView System		X
IVO Smart I2/10 - IP65	X	
IVO Smart I2/15 - 2	X	
IVO Smart 24/6 - IP65	X	
IVO Smart I2/35 - 3	X	
IVO Smart I2/50 - 3	X	
IVO Smart 24/15 - 3	X	
IVO Smart I2/30 - 2	X	
IVO Smart I2/50 - 2	X	
Mass I2/30 - 2	X	
Mass I2/60 - 2	X	
Mass I2/80 - 2	X	
Mass 24/15 - 2	X	
Mass 24/25 - 2	X	
Mass 24/50 - 2	X	
Mass 24/75 - C	X	
Mass 24/100 - C	X	
Mass 24/100 - 3ph	X	
Mass 48/25	X	
Mass 48/50 - I	X	
Mass 24/50 - 2	X	
Mass 24/100 - I	X	
Mass Combi I2/1200-60A	X	
Mass Combi I2/2000-100A	X	
Mass Combi I2/4000-200A	X	
Mass Combi 24/1200-35A	X	
Mass Combi 24/2000-60A	X	
Mass Combi 24/4000-120A	X	
ChargeMaster I2/70-3		X
ChargeMaster I2/100-3		X
ChargeMaster 24/40-3		X
ChargeMaster 24/60-3		X
ChargeMaster 24/80-3		X
ChargeMaster 24/100-3		X
Mass Systemswitc		X

Functions for Mass Combi

The Mass Combi MasterAdjust software allows you to easily check the status of the charger, inverter and transfer system, and to set the parameters of your Mass Combi so as to meet your personal requirements. Although the Mass Combi can be directly installed and used without the need for calibration. A Mastervolt installer can (by means of a password and the Mastervolt website) access more advanced functions. This way, the Mass Combi can be set and calibrated according to the specific technical requirements of the electrical installation.

The functions described below are available as standard. The first screen - Status Overview - gives you a complete and instant overview on the status of your Mass Combi. The readings and settings of the Combi are indicated both graphically and numerically:

AC system:

- Voltage
- Current
- Load
- Operation mode
- Monitoring and setting the Power Sharing mode.

DC system:

- Voltage
- Current
- Load
- Error diagnosis

- Charge current
- Status of the 3-step charge characteristic (bulk, absorption and float).

You can monitor and adjust all variables in the screen Setpoints:

Changing the settings of the battery charger

- Maximum voltage in the bulk charge phase.
- Maximum charge voltage in the absorption phase.
- Output voltage in the float phase.
- The undervoltage level for the starting of a new charge cycle.
- Forced float voltage: constant output voltage in two-step charger mode.
- Voltage compensation for the use of gel or AGM batteries.
- Return amps: the output current of the battery charger at which the battery is considered to be fully charged.
- Maximum charge current.
- Maximum duration of the bulk phase.
- Return to bulk time: delay before the start of a new charge cycle.
- Minimum duration of the absorption phase.
- Maximum duration of the absorption phase.



Technical definitions

Amorphous silicon solar cells

The term amorphous refers to the non-crystalline structure of silicon atoms. The efficiency is lower than crystalline silicon, and typically ranges from 5% to 10%. The energy yield per installed Watt peak is higher compared to crystalline silicon modules because of the relatively high efficiency at low irradiation.

Autonomous PV systems

Supply electricity to locations where no public grid is available or a long distance from that grid. In such situations, a PV system is significantly cheaper than connecting to the mains or a non-stop generator.

Energy-neutral building

A building where the balance between energy production and energy consumption is zero on a yearly basis. This can be achieved by installing various renewable energy sources like PV cells, hot water systems, heat pumps etc.

Grid connected PV system

The low voltage direct current (DC) electricity is converted to 230 V alternating current (AC) power by an inverter. The inverter feeds the electricity, produced by the PV system, back into the utility grid. This means the PV system actually functions as a mini power station. If the solar energy production is higher than the electricity consumption at any given moment, most electricity meters spin backwards. The returned electricity is automatically incorporated in the energy bill.



Inverter efficiency

A percentage that indicates which proportion of the incoming solar-generated electricity is being transformed into useful AC energy. Modern high-quality inverters have efficiencies higher than 92%.

Irradiation

The light intensity in a given area. Africa, for example, receives around twice as much sun as the Netherlands. Irradiation varies within a country too: In the Netherlands for example, it varies between 980 kWh/m² per year in the east to 1070 kWh/m² on the west coast. The average air temperature is also of importance for the annual energy yield of a PV system; solar cells perform better at lower temperatures (see also Underdimensioning).

Maximum Power Point Tracker

An intelligent voltage regulator that adjusts the operating voltage of the PV array to variations in temperature and cell type. A good MPP tracking algorithm draws the maximum solar power from the PV array in all conditions.

Monocrystalline silicon solar cells

Monocrystalline silicon solar cells are cells made from one large monocrystal. Thanks to this method of production we have round solar cells, each made from one silicon crystal. The standard dimensions are 10 by 10 cm. Monocrystalline silicon solar cells typically have an efficiency of 16% to 18%.

Output of a PV system

Solar panels have an efficiency that varies between 8% and 18%. The orientation and shading of the panels and the panel temperature can also affect the eventual output.

Photovoltaic systems

Also known as PV systems. The word Photovoltaic is a combination of the Greek word for light and the name of the physicist Alessandro Volta. It denotes the direct conversion of sunlight into energy by means of solar cells.

Polycrystalline/multicrystalline silicon solar cells

Solar cells made up of multiple silicon crystals. As the crystal edges can impede the electron flow, multicrystalline silicon solar cells are usually less efficient than the monocrystalline equivalent. The output is usually between 14% and 16%. Most polycrystalline silicon solar cells are blue in colour.

Power loss

Power loss can be caused by the location and orientation of the solar cells and other factors such as:

- Placement losses caused by non-ideal orientation to the sun.
- Shading losses: Even partial shading of cells or modules causes relatively high losses.
- Panel losses caused by the electrical resistance of interconnections inside the solar module and losses introduced by series connection of the cells (see String).
- Inverter losses: Solar energy converted to heat and therefore not fed back into the grid.
- Cable losses caused by the electrical resistance of the wiring.
- Temperature losses: solar voltage and power decreases with ±0.5% per degree Celsius. This may lead to relatively large losses at full irradiance (see also Underdimensioning).

Shading

Shading of solar cells may lead to electrical resistance within a closed current loop. This resistance causes the shaded cells to heat up and, if the temperature rises sufficiently, to break down (the Hot-Spot effect). To prevent this, small groups of cells are protected by a bypass diode that stops the shaded solar cells from heating up.

Silicon

Raw material for solar cells.

Solar cell

In a solar cell, light energy (photons) is converted into electric power. See also Working principle of a solar cell.

Solar energy applications

- The active or passive heating of buildings.
- The heating of tap water.
- The generation of electricity (photovoltaic solar energy or PV).

Solar panel

A group of PV cells combined in one unit.

STC or standard conditions

Conditions used to set the panel capacity: a cell temperature of 25 °C and light intensity of 1000 W/m².

String

A group of solar cells (or solar panels) connected in a series. When solar cells or modules are series-connected, the voltage will add up with the number of cells/modules, while the current is equal to the current of one cell. Because of the relatively low current, electrical losses in wiring are low as well. A string of cells or modules performs only as well as the worst cell/module in the string. If differences between solar cells or panels are significant, it may be worthwhile separating lower performance modules from higher and combining them into separate strings. If cells, modules or strings are connected in parallel, the current will add up with the number of units connected in parallel, while voltage remains constant. With both parallel or series connection, the total power generated is the sum of all the power generated by the connected solar cells.

Underdimensioning

Means that the nominal input power of an inverter is less than the power of the PV array, expressed in kWp. In one year, the solar array will seldom generate the specified Watt peak power. In Northern Europe, the inverter input power can generally be chosen to be around 80% of the PV capacity without introducing significant losses.

Watt peak (Wp)

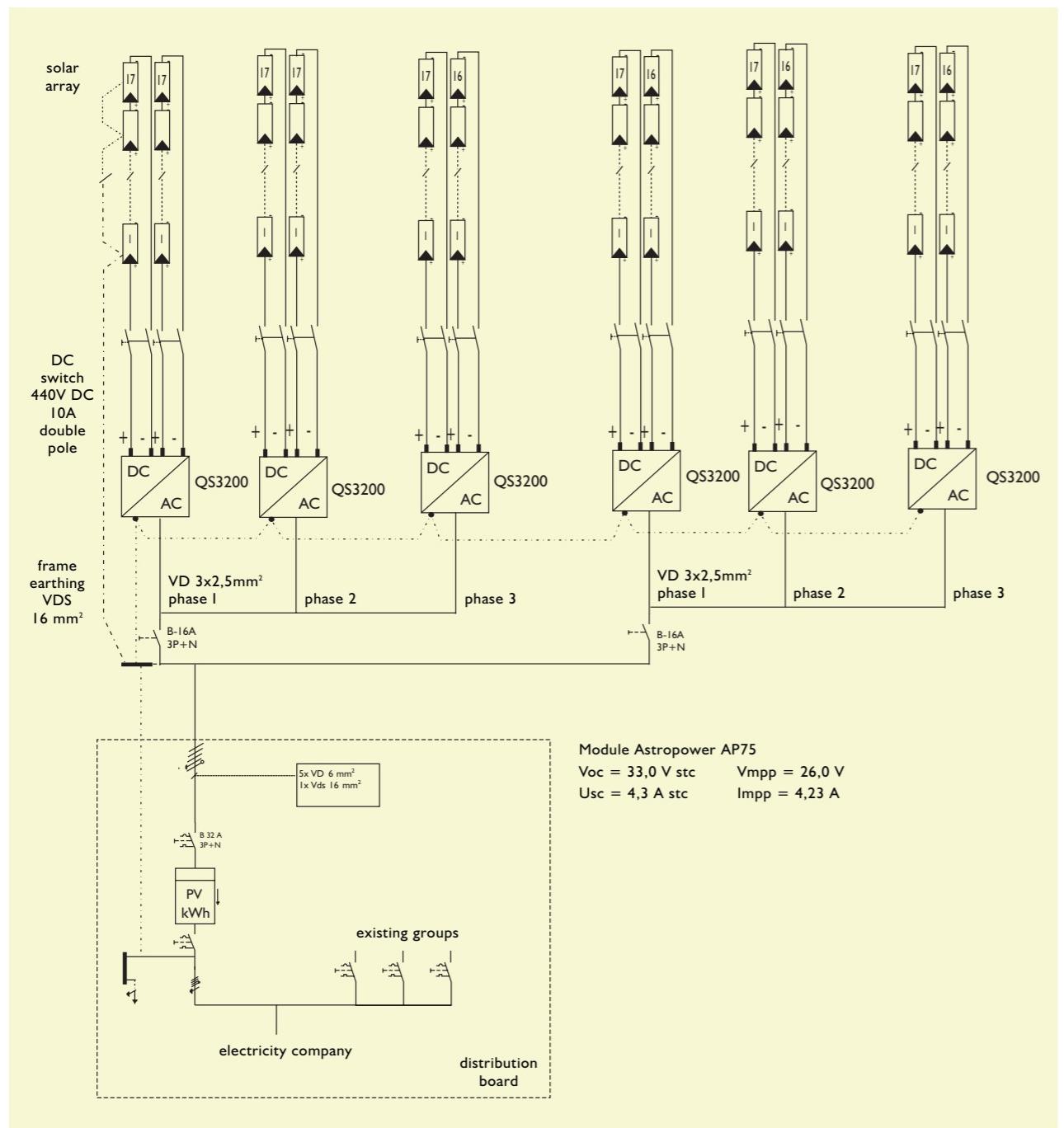
A measure of the electrical power a solar cell or module will generate at standard conditions. See also STC.

Working principle of a solar cell

Solar cells consist of two layers of semi-conducting material, usually silicon. Between these two layers, the n-layer above and the p-layer below, is an electric field. When sunlight shines on the n-layer it is partly absorbed by the semi-conductor and converted into energy (heat). This energy generates electrons that are free to move through the material. The crystalline structure of the silicon and the electrical field ensure that the free electrons move in a certain direction. This phenomenon is called electricity, and the flow is taken from the cell for use in external applications.



System example - grid connected



15 kWp system installed in Greece

This system was installed at the end of 2003 by a local Greek company on a building near Athens. A total of 200 75 Wp Astropower solar panels supply 15 kWp of power for local consumption and returning to the grid. Six Sunmaster QS3200 inverters are placed between the solar panels and the grid. This is a powerful system that meets the required energy needs virtually autonomously.

Frequently asked questions on PV systems

1) What is the best angle for solar panels?

The optimal angle for placing solar panels is 50° for systems in Nordic countries and 20° for South-European countries.

2) How much power will I lose if panels are incorrectly placed?

A system set at an angle of between 20 and 50° facing south will produce around 5% less power per year. When panels are installed at an angle of 35° and the system is oriented between south east and south west, the energy shortfall on an annual basis will again be around 5%.

3) How does heat affect my system?

The output of a system is reduced when panels become warmer. The power shortfall can be 0.3 to 0.5% per °C.

4) What is the life span of a solar panel?

With proper maintenance, the modules should last at least 30 years.

5) How long do inverters last?

You should expect an inverter to function for at least ten years. The actual figures depend on the location of the inverter (the hotter the temperature, the shorter the life span) and whether or not regular maintenance is carried out. A humid environment will affect the life span as well. The ideal place to install an inverter is always in a dry and preferably conditioned environment.

6) Is it possible to remotely collect system data?

There are various options for accessing inverter data. See this brochure for more information or ask your supplier for advice.

7) Do the panels have to be kept clean?

The modules are in principle maintenance free and the panels are washed clean by rain. It is worth considering cleaning the panels with water once every year.

8) What happens if the grid breaks down?

The solar energy unit will stop returning power to the grid. This is necessary to ensure the safety of the system at times when maintenance is being carried out or there is a failure on the grid. Please consult your supplier if you wish to keep receiving a 230 Volt current when the grid shuts down. Mastervolt has various handy options for providing emergency power.

9) Do the panels also provide electricity during cloudy weather?

The panels continue to produce energy even when it is cloudy, albeit on a smaller scale.

10) Can I connect equipment directly to the panels?

Equipment cannot be connected directly to a grid connected solar installation - an electricity grid is always necessary. AC consumers can be directly connected to grid independent sine wave inverters in island systems.

11) Is there any difference in the electricity coming from a solar system?

No, the current is the same.

12) Can my solar installation attract lightning?

There is no record of this ever occurring. The chance of lightning striking is equal regardless of whether or not you have a solar system.

13) Can a solar installation cause damage to my household equipment?

No, this is not possible. The inverter functions as a sort of filter between the grid and the PV system and complies with the highest suppression standards.

14) What happens to the electricity that has been generated but not used?

The electricity generated by the solar panels is first consumed by the various equipment in the building concerned. Any excess power produced is returned to the public grid. Make sure you request from your energy supplier a meter that turns backwards if one is not already installed.



Technical Notes

MASTERVOLT INTERNATIONAL BV

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